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AUTOMOTIVE and Aviation INDUSTRIES

AUGUST 15, 1943

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BEARINGS AND ALLOY STEELS

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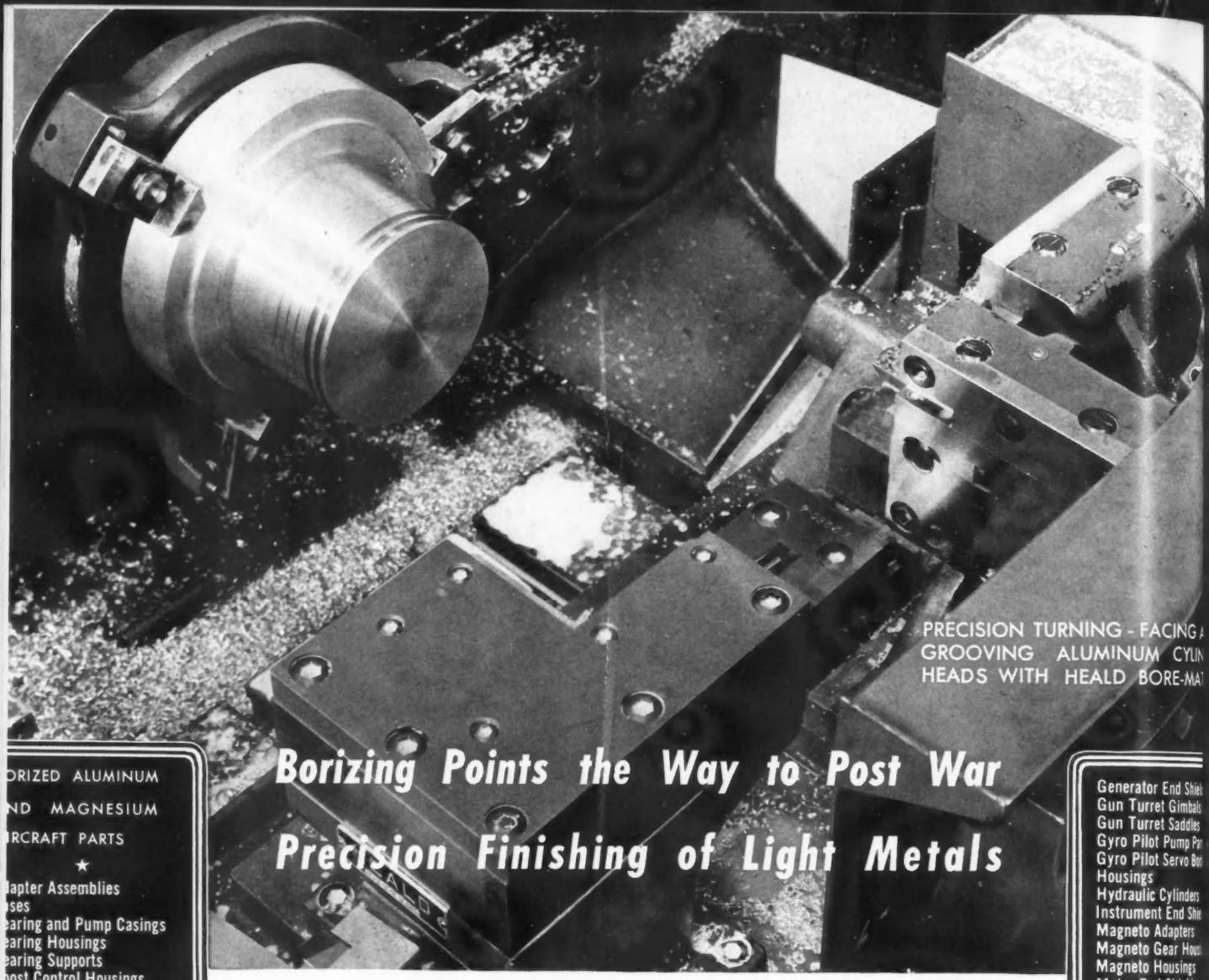

Borizing Points the Way to Post War Precision Finishing of Light Metals

ORIZED ALUMINUM
ND MAGNESIUM
IRCRAFT PARTS
★
dapter Assemblies
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earing and Pump Casings
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ront Covers
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uel Pump Drive Shafts
ear Boxes
ear Cases

What can be accomplished with light metals such as aluminum and magnesium, and indicative of what will be done with these alloys in post-war manufacturing, has already been shown by the aircraft industry. Approximately 40 per cent of the aircraft engine is comprised of light metals, and largely because of this it has been possible to reduce the horsepower-weight ratio to 1 lb. per horsepower.

Just as valuable as the aircraft industry's lesson to the post-war world on the use of light metals are the lessons to be learned from their methods and practices in machining aluminum and magnesium. Their methods of finishing parts made of these metals deserves particular attention. Study of their processes reveals the outstanding fact that *borizing*, or precision boring, turning facing, and grooving with cemented carbide or diamond tools, is used almost exclusively for precision finishing of aluminum and magnesium. The partial list of aircraft parts given herewith is eloquent testimony of this—all of them are made of either aluminum or magnesium and all of them are *borized*.

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Propeller Shaft Bear
Propeller Shaft Plug
Rear Cam Supports
Rear Reduction Gear
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Speed Reducer Hous
Supercharger Bearin
Supercharger Front
Supercharger Gear C
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Valve Guides
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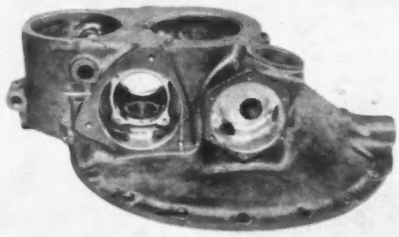
Volute Casings
Water Pump Casing
Wheelcases



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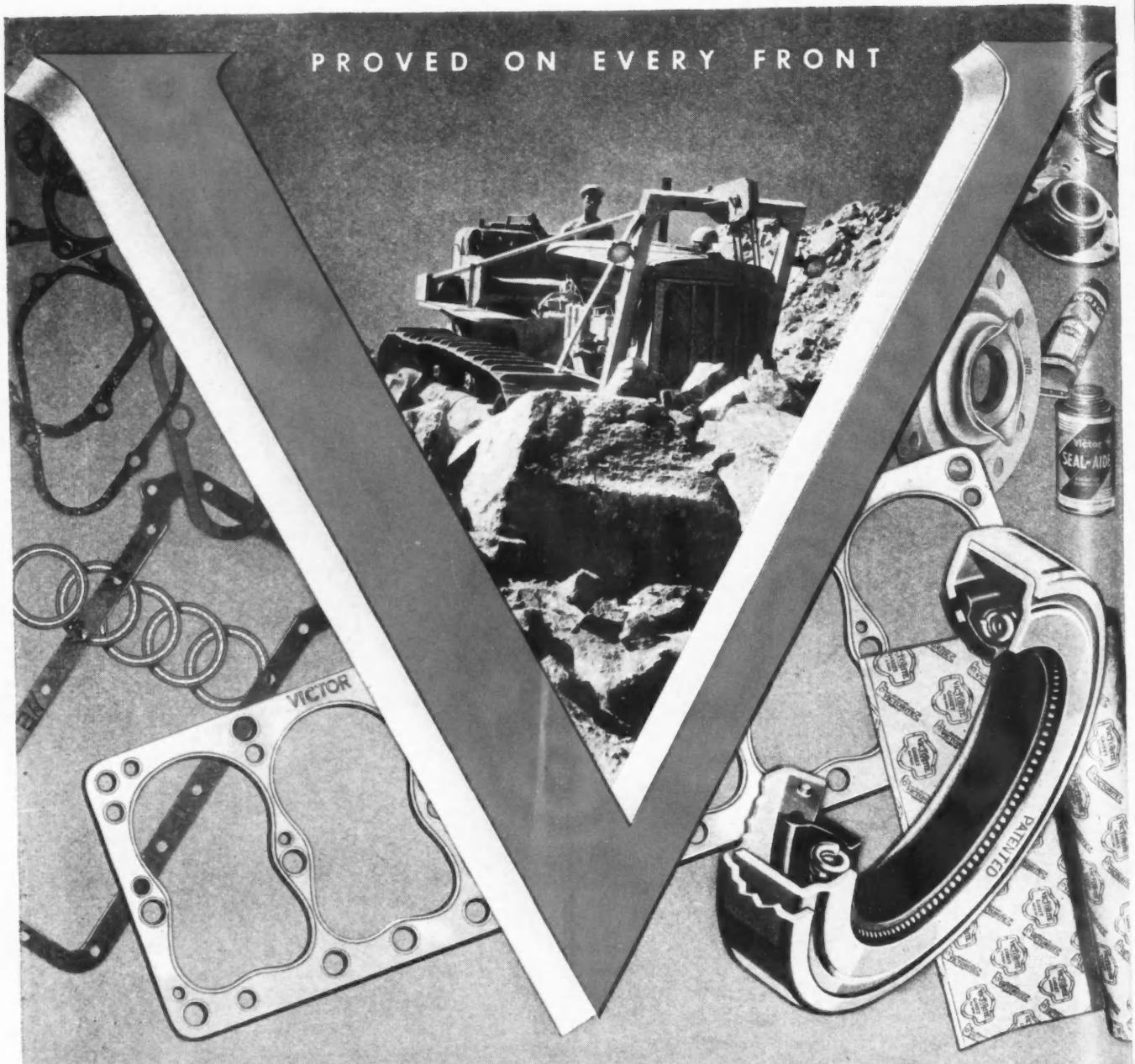

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IN THIS ISSUE . . .

AUTOMOTIVE and AVIATION INDUSTRIES

Volume 89 August 15, 1943 Number 4

AUTOMOTIVE INDUSTRIES

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Fewer Cars on the Road

For every 100 motor vehicles on the roads in the East in June, 1941, there were only 40 in June, 1943. In the West and Middle West, during the same months, the drop was from 100 to 57. Comparable figures in June, 1942, were 66 for the East and 76 for the remainder of the country. In relation to the corresponding month in 1941, traffic volume in the East was lower in June than in any other month since rationing began. The greater reduction in the East than in the rest of the country in 1942 occurred during rationing in the East only, and at a time when there was a gasoline shortage in the area. In 1943, rationing in the East was more severe than in the rest of the country.

Before rationing, traffic in the West declined 24 per cent in June 1942, compared with June 1941. The further decline in the West took place under rationing. Motor fuel tax collections in the first six months of 1943 were down 38 per cent in the East and 27 per cent in the western rationed area, compared with the first half of 1941.

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Get back of the Pay-Roll Savings Plan by encouraging employees to turn part of their earnings *regularly* into tanks and planes and guns through systematic purchase of

U. S. WAR BONDS

Civilian Automotive Advisors Keep Army Wheels Turning 17

Over 1600 civilian men have been drawn from the fold of the automotive field to act as expert advisors in the training of the enlisted men. These men bring the army personnel up to a high degree of efficiency in all things automotive, from driving to maintenance. It's interesting. Read this article.

Details of the British Karrier-Humber Armored Car 19

Here is description that has just been released by the British army. In some respects it is similar to other models of British armored cars but with a number of innovations.

Radio Type Flight Test Apparatus 24

This setup was described in a general way in an earlier issue. Here, however, are all the details of design and operation. Liberally illustrated too.

Mosquito Legs Equipped with Rubber Pack to Absorb Shock 29

Here is distinctive feature of the British deHavilland warplane. The design is unique for planes of this size. Text and illustration describe it fully.

Knotty Problems Ahead in the Postwar Car Market 30

Here is an analysis of the conditions we are to meet when this war is over and we are "back to normal" . It goes right down to the root of things with facts and figures and charts that give a clear picture of just what is ahead for us.

Short Cuts 32

This feature is getting more and more followers with every issue. If you are not following it closely you are passing up material that is really "sure fire". Here is another hot tip. Read NEW PRODUCTION EQUIPMENT on page 46; NEW PRODUCTS FOR AIRCRAFT on page 58 and NEW PRODUCTS on page 78.

SOFT LANDINGS!

— MR. BREN GUN CARRIER

★ Imagine the shock these Muehlhausen Springs must absorb when this Bren Gun Carrier hits the ground—the thousands of pounds they must cushion to protect this overgrown jeep.

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AUTOMOTIVE and AVIATION INDUSTRIES

Published on the 1st and 15th of the month

Vol. 89, No. 3
August 15, 1943

Civilian Automotive Advisors Keep Army's Wheels Turning

By E. L. Warner, Jr.

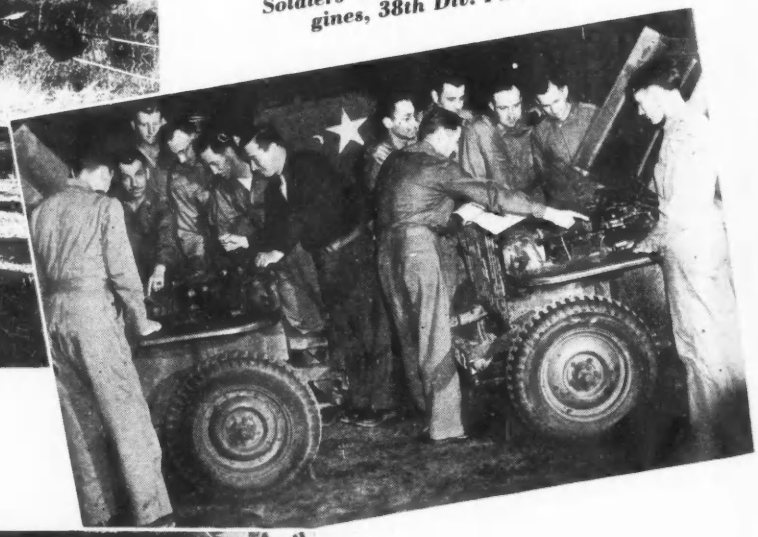
WHEN the United States Army was put on wheels three years ago with the ultimate prospect of fighting the Axis powers, few of the men were adequately trained in the upkeep and maintenance of the many vehicles that comprise a combat division. This fact was brought home graphically in the 1941 army maneuvers along the Carolina seaboard. Many deficiencies were noted in driver training and in first and second echelon maintenance of motor vehicles in the field. It was imperative that some action be taken to prolong the life of the military vehicles, minimize parts replacement and reduce the work load on the overburdened fourth echelon shops. In order to promote the efficient utilization and conservation of the Army's motor vehicle equipment, a committee of transportation experts recommended that qualified automotive maintenance men from industry be called in to serve as civilian advisors.

First of these civilian automotive advisors to be appointed was James A. Bell, an executive of the Four Wheel Drive Auto Co., who had served as a captain in the Motor Transport Service during World War I. He reported for duty Feb. 26, 1942, with the 26th Infantry Division, comprising part of the Eastern Defense Command, which extends from Maine to Florida. Eight months later Bell was placed in charge of the civilian automotive advisor program in Washington. By that time, there were 1100 civilian automotive advisors in the field and the number has now increased to over 1600. The advisors come under the Preventive Maintenance Section of the Maintenance Branch, Field Service Division, Office of the Chief of Ordnance, headed by Col. G. W. Vaughn. Headquar-

Instruction in Slack on Tank Track (12th Armored Div. Photo)

Civilian Motor Advisors to the 98th Div. making field demonstration for men of the Service Co., 389th Inf., in the use of an "A" frame and winch to lift a 2½-ton truck out of an abrupt ditch (164th Signal Corps Photo)

Soldiers Learn about Jeep Engines, 38th Div. Photo)



Advisor Gives Instruction on parts truck (38th Div. Photo)

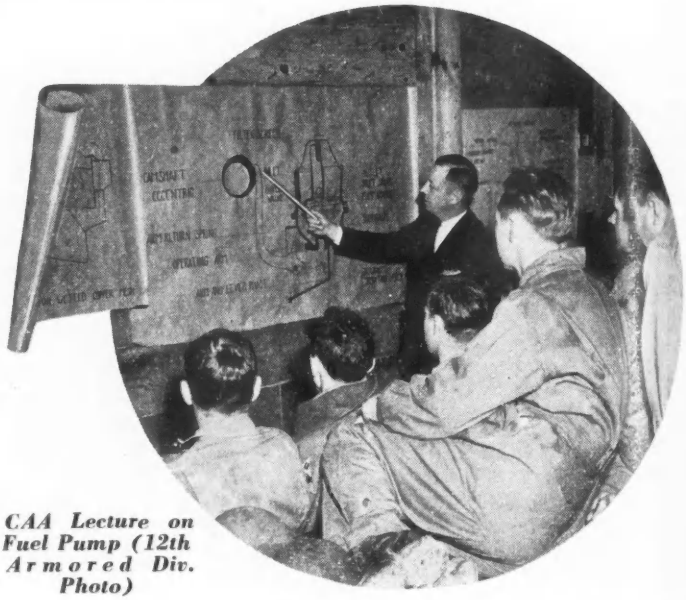
Civilian Automotive

So the civilian automotive advisors have filled a very real need in helping the growing army provide the necessary instruction on maintenance of trucks, tanks and combat vehicles. The civilian advisors were recruited from among fleet superintendents, maintenance managers, shop foremen and service managers of some of the leading com-

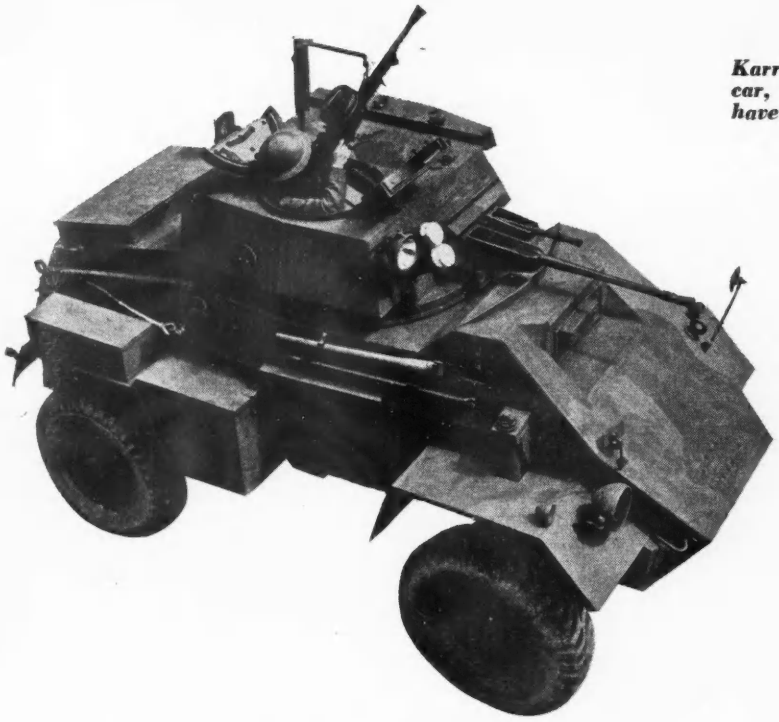
(*Turn to page* 81, *please*)

ters are in the Tank-Automotive Center at Detroit.

These advisors train 500,000 men daily in the principles of vehicle maintenance in the largest training unit outside the Army Ground Forces. In the mechanized and motorized army of today, one-third of the personnel of a combat division has to be versed in motor vehicle maintenance. Very few of the officers or non-commissioned officers have had the experience necessary to qualify them for maintenance of their vehicles or to teach the enlisted men such subjects. The Motor Transport Section of the Quartermaster Corps had maintained a motor maintenance school at Camp Holabird, Md., but the rapidly expanding army soon outgrew the facilities there.



CAA Lecture on Fuel Pump (12th Armored Div. Photo)



Karrier (Humber Mark III) armored reconnaissance car, a British production of which large numbers have been in operation in North Africa and elsewhere.

By M. W. Bourdon
Special Correspondent of
AUTOMOTIVE *and* AVIATION
INDUSTRIES in Great Britain

Constructional Details of British Karrier-Humber

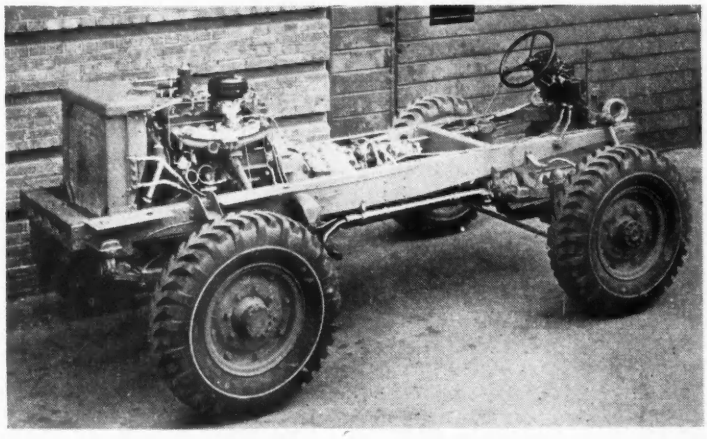
Armored Car

IN AUTOMOTIVE *and* AVIATION INDUSTRIES of June 1 an illustrated description was given of an armored reconnaissance car designed and built in large numbers for the British Army by the Daimler Motor Co., England. Particulars and photographs have now been released of another British vehicle of similar type and purpose that has been extensively and successfully used on various fighting fronts, notably in North Africa. In this case, two of the units of the Rootes organization, Karrier and Humber, have been responsible for its design and production. (Rootes, it may be recalled, controls the Hillman, Humber and Talbot companies manufacturing passenger cars in peacetime, and the Commer, Karrier and Sunbeam plants producing trucks and buses.)

Known as the Karrier (Humber Mark III) armored car, it is equipped with four-wheel drive for cross-country work, eight speeds forward, and rear engine. The superstructure is a compact hull and turret of bullet-proof steel accommodating a crew of four—commander, gunner, driver and radio operator. The turret, mounted on ball bearings and operated by the gunner, has a single-speed traversing gear and can be rotated through 360 deg. All seats, except that of the driver, are suspended from the turret and, therefore, rotate with it. Armament consists of two co-axially mounted Besa guns of 15-mm and 7.92-mm caliber, and an independent .303-in. Bren gun.

Basically, the engine is one of the standard power units of Commer and Karrier trucks with numerous appropriate modifications. It is a six-cylinder side valve unit with a bore and stroke of 85 by 120 mm

(*Turn to page* 91, *please*)



Chassis of the Karrier (Humber Mark III) armored car. Part of the radiator unit behind the rear engine serves as an oil cooler.

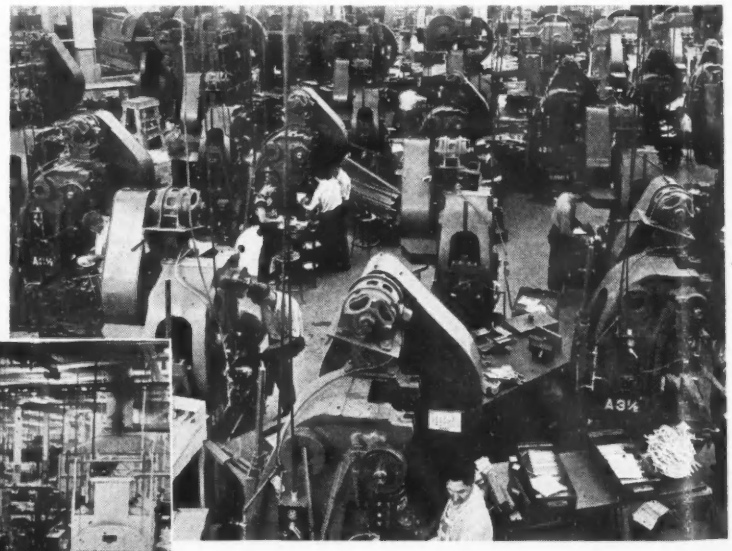
Spot welding is used extensively in the cowl department where two rows of Sciaky welders are kept busy.

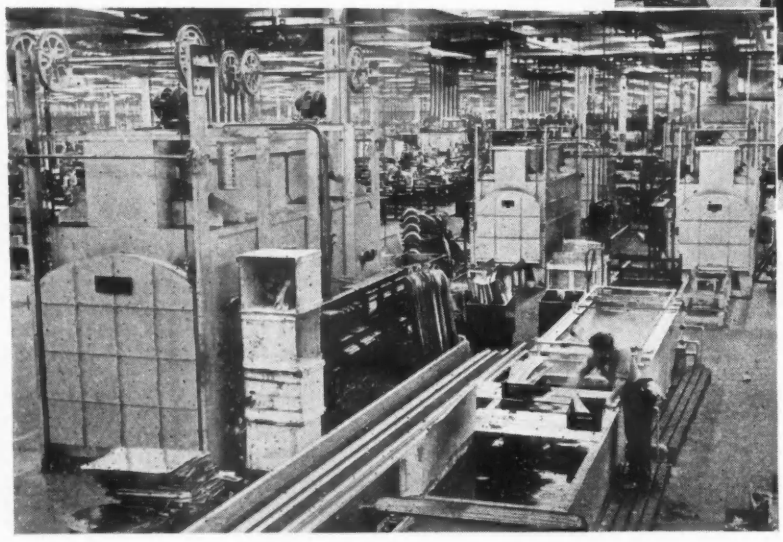
Curtiss-Wright Well Organized for

By Joseph Geschelin

THIS article is concerned with the contribution to the war being made by the Curtiss-Wright Corp. While this organization has established manufacturing plants in the states of New York, Missouri, Ohio, and Kentucky, this report presents only the operations in New York. The setup of the latter embraces two plants, of which Plant 2 is devoted to the final assembly of the Army Air Forces Cargo airplane and the P-40 Pursuit. In addition, Plant 2 has self-contained fabrication facilities comprising machine shops, paint shops, sheet metal fabrication and assembly of nacelles, wings, wing center sections, etc. Plant 1 is used exclusively for manufacturing, producing all fuselage sub-assemblies for Plant 2, housing a large sheet metal fabricating activity, and boasting a tremendous machine shop operation.

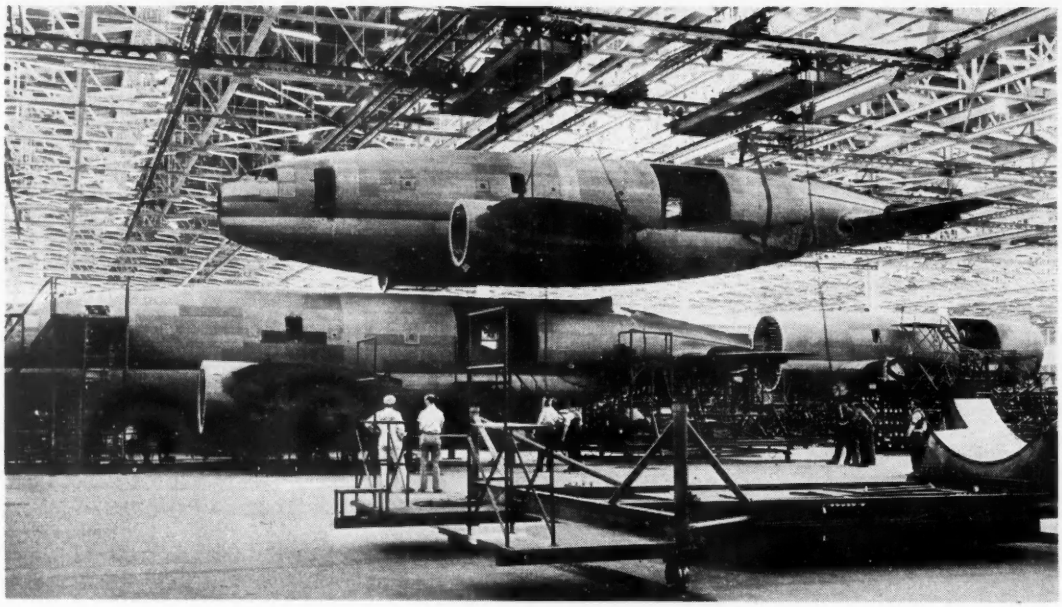
From the standpoint of sub-contracting, it is of interest to learn that Curtiss-Wright had a sub-contracting department as early as 1936 which was greatly expanded during 1940 when the impact of the war overseas began to be felt. This was followed by the establishment of sub-contracting departments in each of the manufacturing plants, followed after we entered the war by the organization of an Industrial Contracting and Planning Section to coordinate sub-contracting activity. Today, plants from coast to coast are making such parts as outer panels,





(Above) General view in Plant 1 press shop with a large group of Niagara presses in the foreground.

(Left) Perspective of heat treating department in Plant 2 features a large battery of Lindberg electric furnaces. A quenching tank is shown in the foreground.



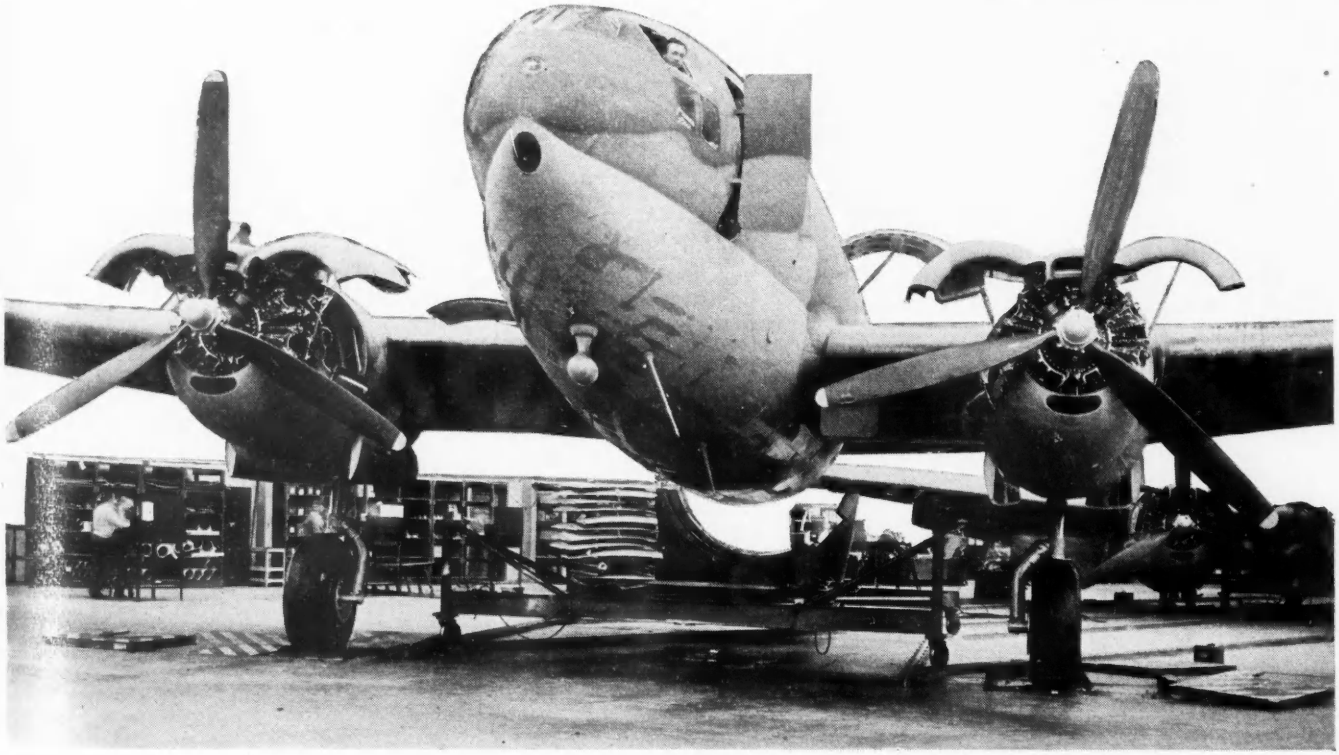
The giant fuselage is shown being transported from the secondary splice fixture to the waiting production line cradle. Note the center fore and aft sections of the fuselage in the primary splice fixture in the right hand background. Hoisting equipment is Cleveland Crane and Engineering Company's.

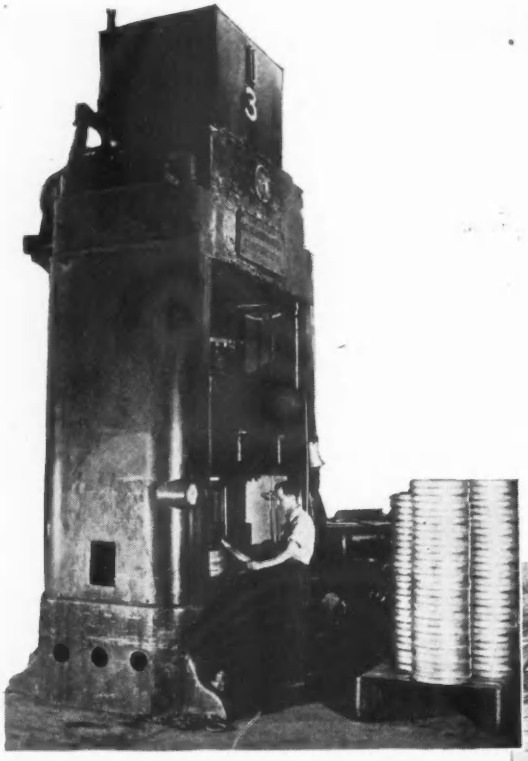
Warplane Production

center sections, fuselage sections, landing gear, tail wheel assemblies, oil and fuel tanks, etc. Among the manufacturers participating in this program are—motor car producers, stove, rubber, refrigerator, autobody, too, piano, farm implement, and furnace companies and others who had no connection with the aircraft industry before the war.

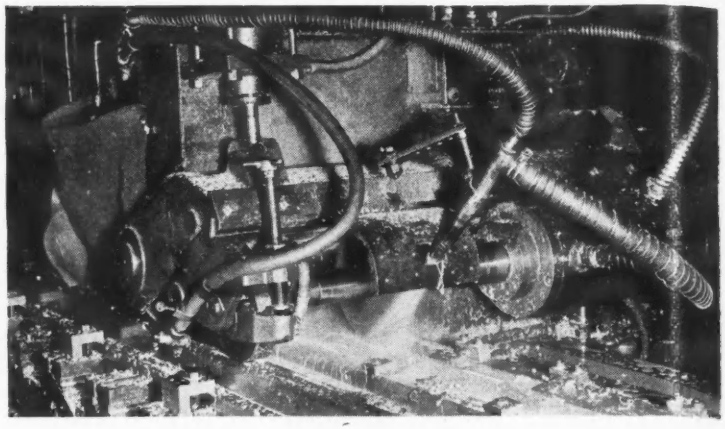
To supplement these widespread facilities, Curtiss-Wright is set up to produce a certain percentage of every component used in each of its assembly plants. This arrangement serves a two-fold purpose. First

C-46's ride the assembly line on low-mounted cradles to facilitate the work of operators and in the interest of safety. Near the end of the line, pit-mounted hydraulic hoists lift the ship on its extended landing gear, thus unmounting the ship from its cradle.

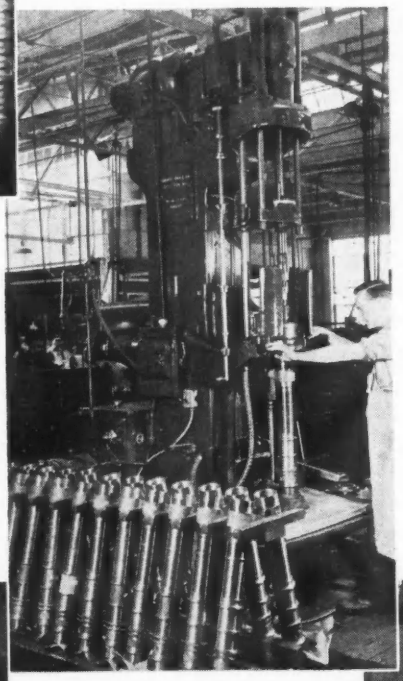




(Above) One of a battery of newly installed H-P-M hydraulic presses used for the forming of C-46 cowling sections.



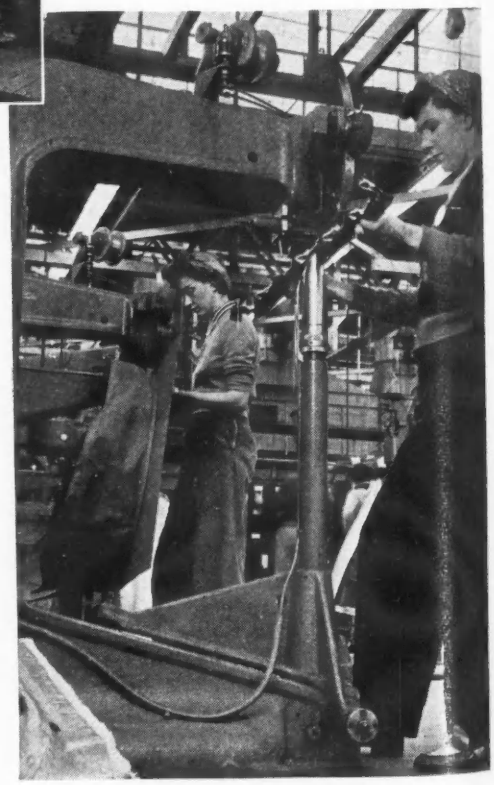
Close-up of the work station of one of several new Onsrud Spar Millers used for intricate milling and forming of the long aluminum alloy extrusions for the C-46.



(Center) In Plant 2, Barnesdrill hydraulic honing machines fitted with Micromatic tools finish-hone the bore of P-40 landing gear cylinders.

of all, it assures a continuity of plane production even if there is an interruption of deliveries from any of the subcontractors; secondly, it affords an opportunity of an interchange of know-how between the company and its suppliers, providing a further medium for the transfer of information concerning design changes and improvements in techniques and tooling.

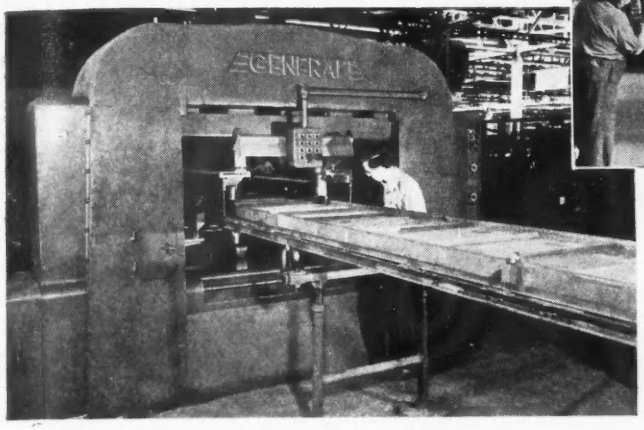
Interchangeability becomes of paramount importance in



(Right) Versatile Morrison Metal Stitcher has been found particularly useful in fastening canvas, asbestos, and felt strips to metal. It also is used for stitching metal to metal.

One of the largest pieces of equipment in the plant is this 3000-ton Clearing hydraulic press fitted with multiple table arrangement for the formation of various sheet metal parts, using the rubber pad method.

(Below) ‡G-3000 General Automatic Riveter, the first machine of this type, is saving 72 per cent over the former riveting method used on this 30 per cent spar of the C-46. Almost human in operation, this intricate machine automatically positions the spar, adjusts the riveting rims, rivets and moves to the next position without attention from the operator.



(Above) On the P-40 assembly line. The fuselage assembly has just been attached to the wing panel assembly and the entire unit is being lowered by electric hoist onto the production stand, ready to wheel on the assembly line.

this setup, since parts and sub-assemblies received from many outside plants must be capable of ready integration on a Curtiss-Wright assembly line. To perfect this system, Curtiss-Wright has made it a practice to furnish the basic inspection gages and inspection fixtures to all sub-contractors, coordinating this equipment with master gages in its own plants.

In this article we shall confine the discussion to Plant 2 which produces the fast Pursuits and the C-46 Commando Cargo plane. This plant will be described sketchily since the pictorial evidence constitutes the best way for the reader to visualize its widespread scope.

One section of the Plant 2 is devoted entirely to the assembly of the Pursuits on a long final assembly line which will

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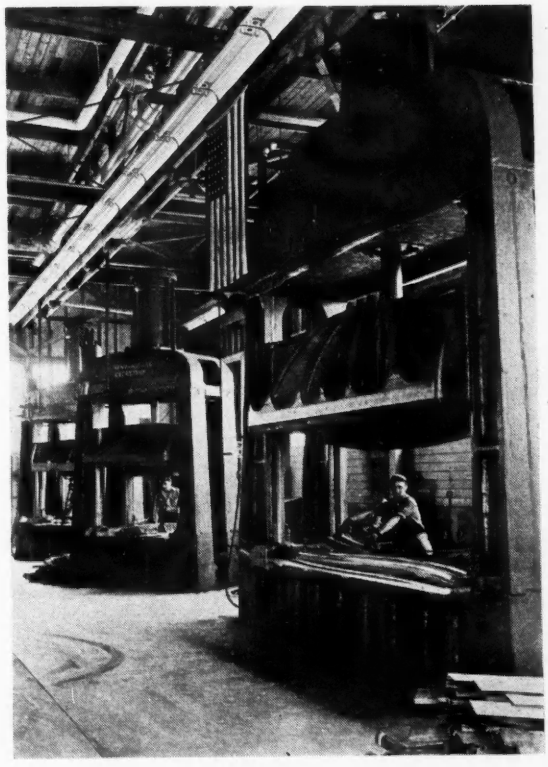
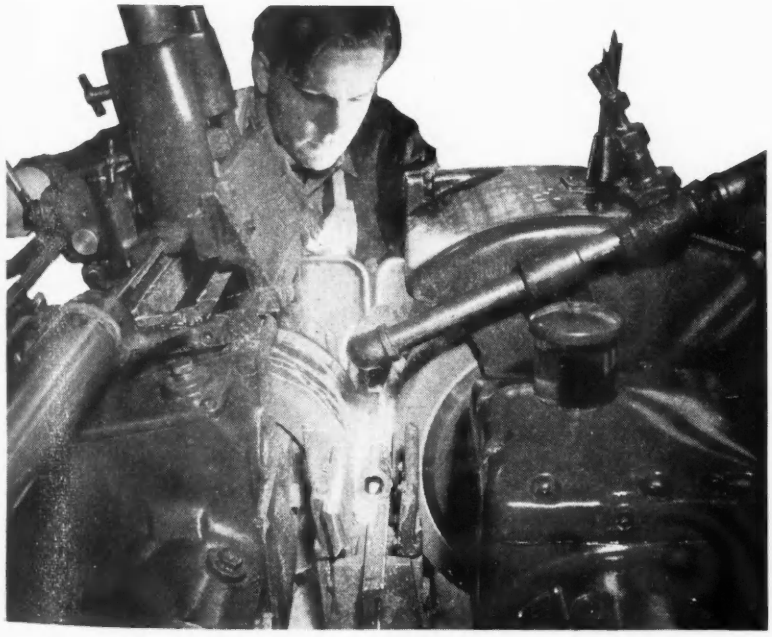


(Above) View of part of battery of Chambersburg Cecostamp hammers in the Plant 1 hammer shop. These air-operated hammers combine the normal squeeze of a press with the unique ability to strike the sharp blow required for the forming of more elastic materials. In addition, these hammers have provision for sensitive control so essential to precision operations. In the foreground is the new 156 x 60 in. hammer; in the background are a 66 x 60 and a 66 x 48 hammer.



(Left) Latest type of Cincinnati centerless grinder, one of a large battery, is employed for grinding various machined parts.

Operating Principles of the Vultee Radio-Type

IN the Jan. 1 issue of AUTOMOTIVE AND AVIATION INDUSTRIES was illustrated and briefly described a new set of instruments developed by Vultee Field Division of the Consolidated Vultee Aircraft Corp. by means of which the responses of numerous pickups or instruments on an airplane in flight can be transmitted to and recorded at a ground station. The advantages of such apparatus were pointed out at the time, but little was said regarding its design and principles of operation. Information regarding the technical features of the set are now presented herewith.

Equipment carried on the plane includes a variety of pickups sensitive to variations in temperature, pressure, fuel flow and position of the throttle, flap, etc.; it also includes a scanning switch weighing 12 lb and displacing ¾ cu ft by means of which the various pickups or instruments are scanned at 0.01 sec intervals, and a converter unit which converts the responses of the pickups into radio-frequency oscillations which are fed into the microphone input of the transmitter. This last-mentioned unit occupies 1 cu ft and weighs 15 lb.

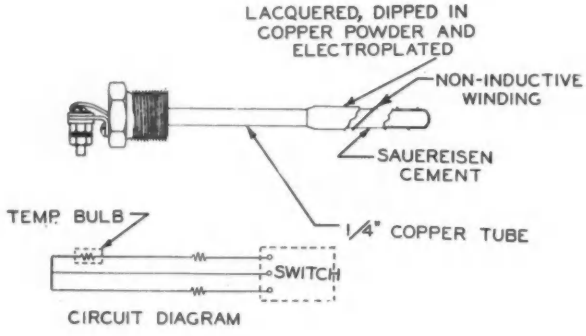


Fig. 1—Temperature bulb and circuit diagram

Each pickup with its leads forms two arms of an a-c bridge. The temperature pickups are of the resistance type and are designed to follow rapid changes in the temperature of the medium concerned. As shown in Fig. 1, this pickup consists of a thin copper tube, a heat insulator of special cement, a resistance wire winding and a thin copper plating over the winding. All parts being made of copper, errors due to unequal heat expansion are eliminated. The unit is connected into the bridge as shown by the diagram. For recording relatively high temperatures, such as those of exhaust gases, a similar unit is used, but stainless steel and platinum wire are substituted for the copper.

For strain measurements use is made of a regular wire-wound strain gage as illustrated in Fig. 2. An unstressed gage of the same type is mounted adjacent to the strained gage, and the two are connected to form two arms of the bridge, this arrangement eliminating effects due to temperature changes.

Positions of control surfaces are indicated by operating a potentiometer through a suitable leverage, as shown diagrammatically in Fig. 3. Pressure pickups comprise standard diaphragms

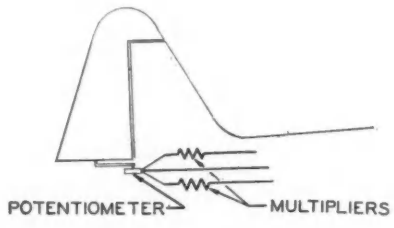


Fig. 3—Measurement of angular movements

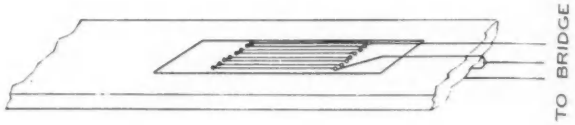


Fig. 2—Strain gage

whose movements cause a small armature to move between two coils which form two arms of a reactance bridge (Fig. 4).

Reactance bridges are used also in other units, such as that for measuring the deflection of a spring in a push-pull flight-control rod, Fig. 5, or the movement of an instrument element. Each pickup and its leads form two arms of a bridge which are connected by the switch to the other two bridge arms

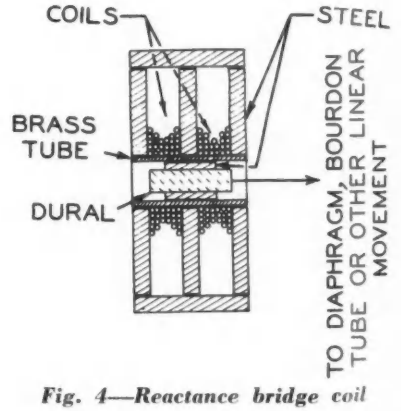


Fig. 4—Reactance bridge coil

that are built into the converter (Fig. 6).

The pickup bridges, Fig. 7, are energized by an a-c generator C and are scanned in rapid succession by switch B. The amplitude of the bridge carrier is changed or modulated by the gage under the influence of the stimulus being measured, which results in a change in amplitude of the bridge carrier D. This is amplified at E and rectified at F, thus producing a large d-c amplitude change corresponding to the change in gage A. Direct current is fed through F into the control grids of a pair of reactance tubes which act as part of the capacity and inductance of

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Instrument and Electrical Development Engineer,
Vultee Field Division of Consolidated Vultee Aircraft Corp.

Flight-Test Apparatus

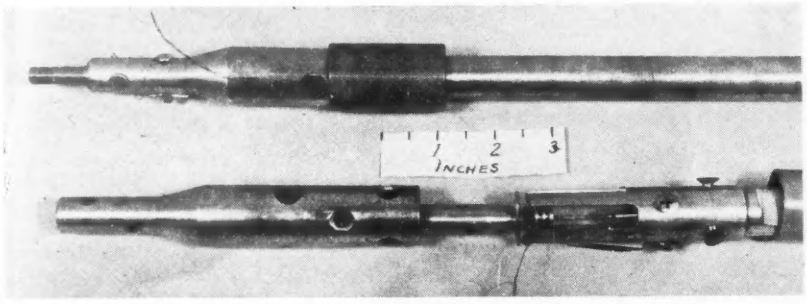


Fig. 5—Push-pull flight-control rod

an oscillator circuit H. The frequency of this circuit varies between 4,000,500 and 4,005,500 cps, in accordance with the amplitude of F, and a frequency modulation G as shown is thus obtained. This varying frequency beats against the fixed frequency of oscillator K, which causes a beat note J of between 500 and 5500 cps. The audio signal J is then fed into the microphone line of the airplane transmitter.

Transmitted signals are picked up at the ground station and recorded. In most cases a disc recorder is used to make a master record, to provide against failure of any of the other instantaneous recorders or of the decoding apparatus. In addition, the signals can be decoded electronically and recorded on paper charts, the chart width and accuracy depending on the speed of the scanning switch in the airplane. In powerplant studies, where readings taken at the rate of one instrument per second are satisfactory, direct paper charts of 6-in. width can be made on a commercial pen-and-paper recorder.

In such studies as that of load distribution during maneuvers of the airplane, readings may be taken at the rate of 100 per sec, with signals recorded on both disc and film. These recordings may be made either simultaneously, or the film may be rerecorded from the disc.

Decoding of the signals of the film (Fig. 8) and identification and plotting of the readings of each pickup on a separate chart are accomplished automatically on the Vultee radio recorder analyzer. This consists of a means of projecting each image of each instrument signal through an optical scanning system which determines the frequency of the recorded signal and then plots the related amplitude on a pen-and-ink chart. In addition to converting the frequencies to their corresponding amplitudes, the analyzer moves the correct chart for each pickup into the proper recording position when the film image of the pickup is moved into the decoding system. Changes in the stimulus for each pickup are thereby plotted on a separate chart. This automatic decoding and plotting takes approximately 3 sec per indication.

A change of 5000 cps has been arbitrarily chosen for the total range of the instrument. Each pickup, therefore, is designed to cause a change of 5000 cps in the converter unit when the pickup is subjected to the maximum change in stimulus which it is required to measure. For instance, a strain gage having a range of 50,000 psi and subjected to a loading of 10,000 psi will produce a change of 1000 cps in the converter unit, and this loading will be plotted at one-fifth full deflection on the chart. An air-speed pickup designed for a range of 500 mph will, when the ship is flying at 100 mph, cause a frequency change of 1000 cps in the converter unit, and this speed will be charted at one-fifth full deflection on a chart having a full-scale range of 500 mph.

As an additional check on the accuracy of the system, two dummy gages are included with the active gages on

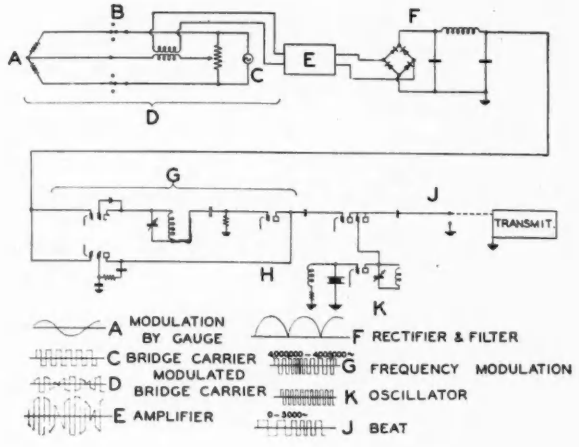


Fig. 7—Schematic wiring diagram

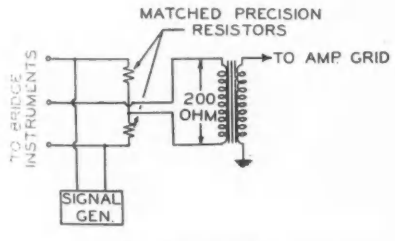


Fig. 6—Bridge diagram

the ship. These are designed to produce 1000 and 5000 cps—a spread of 4000 cps—in the converter unit. If any variation should occur in the equipment on the plane, due to changes in either the power supply, temperature or power of the tubes, the 4000 cps spread would immediately indicate it, so that a suitable correction could be made by means of the analyzer. Therefore, all variables in the pickups, the converter unit in the airplane, and the analyzer are either automatically cancelled out, or are recorded so that both time and amplitude of their occurrence are known.

When recorded on film, the instrument frequency can be projected and determined with an average accuracy of 1 in 250. If a large number of such determinations are required, the work can be facilitated by projecting the instrument frequencies on a revolving drum calibrated in cps. Automatic analysis is used for all readings which need not be closer than plus or minus 1 per cent.

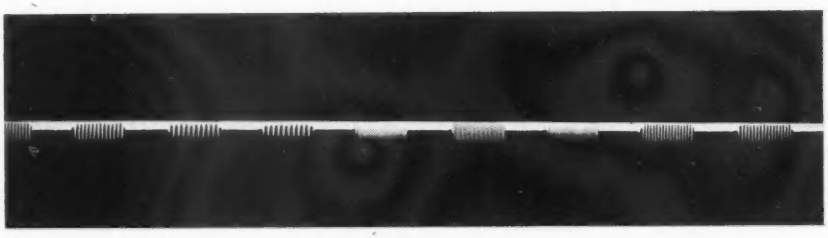


Fig. 8—Signal recorded on sound film

Strain gages used with the recorder have a resistance of 88 ohms and vary by 2 ohms for a stress range of plus 60,000 to minus 60,000 psi in aluminum alloy 24 ST. When it is desirable to measure small loads under special conditions, the converter unit can be made to swing through its entire range by increasing the gain on the bridge amplifier so that strains can be read over a total range of approximately 3000 psi.

When pickups are more sensitive than required, shunts or multipliers are used to control their ranges. Temperature pickups (Fig. 1) are made to approximate specification ranges and then, by the use of multiplier resistances in series with the unit, the ranges are adjusted as desired. The original temperature pickups consisted of windings of alloy wire on cores of different materials, but these were found to be unsatisfactory, due to strains in the resistor element caused by unequal expansion and contraction of the parts. The present unit consists of a single layer—approximately 1 in. long—of No. 36 copper wire on a thin core of copper tubing. With this unit there is a straight-line relation between resistance and temperature, whereas units made of a combination of different metals showed non-linear relationships. A standard temperature unit for a range of 150 C contains approximately 4 ohms of the No. 36 wire in series with 100 ohms of zero-temperature-coefficient resistance in its arm of the bridge. The resistance in the other arm of the bridge determines the zero of the range. For instance, if this be 104 ohms all resistances being measured at a room temperature of 20 C, the bridge will balance at 20 C and will cause a frequency output from the converter of 500 cps. When the temperature at the pickup is increased to 170 C, the converter frequency will become 5500 cps. On the other hand, if it is desired to measure from minus 70 C to plus 80 C, the same unit can be used with 100 ohms in series with the active unit and 100 ohms plus the resistance of the unit at minus 70 C. This will cause the bridge to balance at minus 70 C and provide a frequency of 500 cps at minus 70 C and 5500 cps at plus 80 C. In regular service, units are set to measure the desired ranges, individual chart calibration strips being prepared for each unit. These strips are attached to the final charts from the analyzer, which makes it possible to use the entire chart width for all pickups regardless of their respective ranges. This is true because each unit and the graphic recorder cover the same frequency spread.

The pressure units are equally flexible. A given diaphragm and reactance-coil combination can be used to record full-scale charts for ranges of up to 20, 30 and 60 in. of water column, and 10 in. of mercury column. As shown in Fig. 9, this is accomplished by changing the fulcrum of a double-armed lever to give approximately full armature movement for the diaphragm deflection at the desired range. The maximum unbalanced condition of the reactance unit is then shunted with sufficient resistance to cause the bridge unbalance to activate the converter to 5500 cps. The standard reactance unit, Fig. 4, consists of two coils, each of ¾-in. outside diameter and 1/16 in. long, having equal inductance (about 1.5 millihenries), wound on a ¼-in. copper tube and separated and covered by a 1/16-in. iron casing.

When coils of equal inductance are used, the armature extends from center to center of coils when the bridge is balanced, and moves 1/32 in. for maximum unbalance. In the latter position the armature completely closes one coil and opens the other.

Calibration of position indicators can be effected by both mechanical and electrical means. Wire-wound potentiometers of suitable values are used with multiplying resistors to give the correct range. Mechanical systems are designed to use 50 per cent or more of the available rotation of the potentiometers.

Tachometers are multipole alternators designed to convert the desired range of rpm into a related range of cps which falls within the established frequency swing of the radio recorder. The output of the tachometer unit is

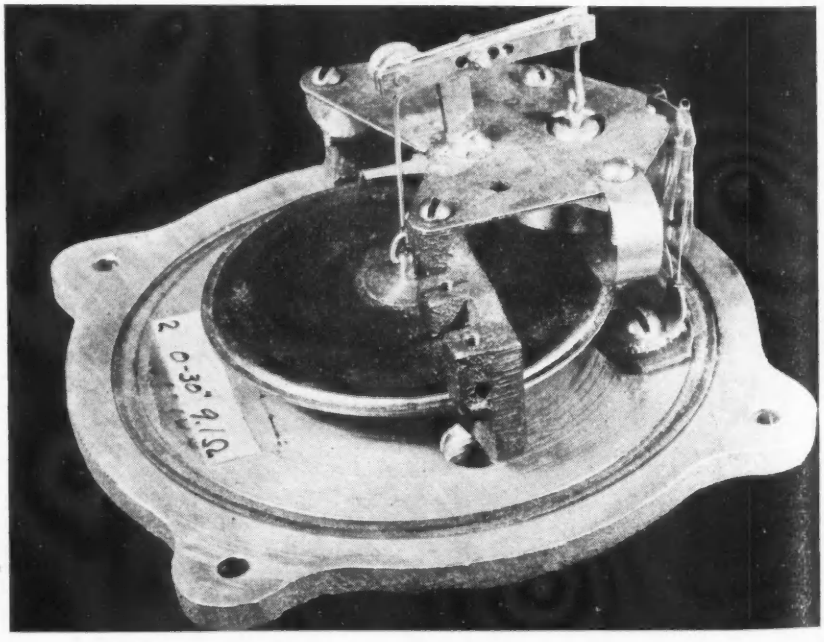


Fig. 9—A typical pressure pickup with variable fulcrum for different pressure ranges

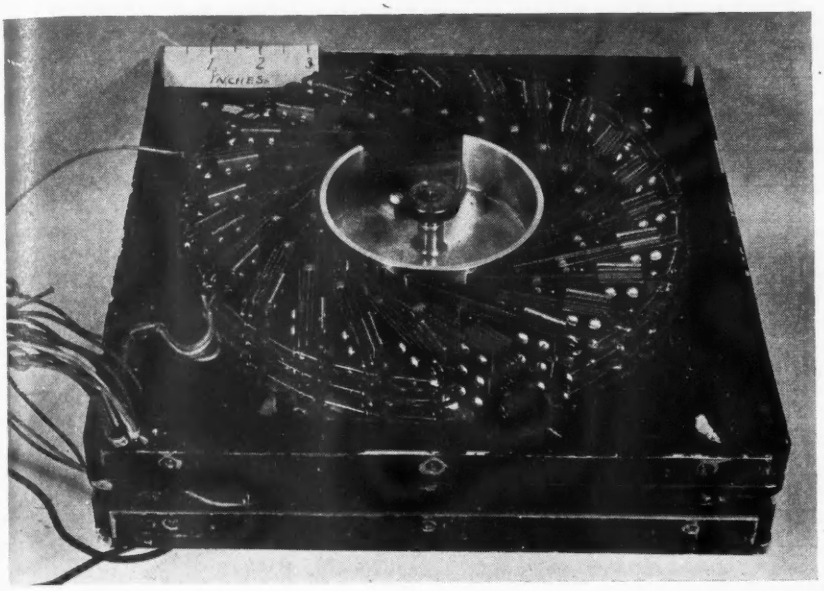


Fig. 10—The scanning switch

investigated and found to be unsatisfactory at high speeds, because of vibration. The present-type switch, Fig. 10, consists of leaf-type contacts actuated by a cam. One arm and the amplifier input of each bridge pass through the switch, while the opposite arm is connected directly to a converter connection common to all pikups. The leaf swithes are so adjusted that the arms of the bridge are completed before the amplifier input contact is made, thereby preventing overloading in the amplifier while the bridge is open on one arm. The tangential arrangement of the switches with respect to the cam allows the actuating arms of the leaf switches to ride on the small circumference of the cam, thus preventing bouncing. The actuating cam is designed to give uniform pressure on the switch while in contact.

fed through the scanning switch to the radio transmitter as audio modulation.

The number of poles of the tachometer is determined by the rpm range to be scanned. Suppose for example, that records of engine speeds between 500 and 4000 rpm are desired. Since the tachometer shaft rotates at one-half engine speed, a 120-pole generator would produce 500 cps at an engine speed of 400 rpm and 4000 cps at 4000 rpm. This generated signal can then be recorded and analyzed by the same methods used to record and analyze the signals from the converter unit. The frequency generators used with the radio recorder consist of a steel gear whose teeth pass the pole of a permanent magnet. In the above example a 120-tooth gear would be used.

Since all pickups are set to a "common denominator," calibration of the converter unit is accomplished by setting the gain of the bridge amplifier to produce the desired frequency swing. For ease of calibration, this "common denominator" has been fixed as the change in the output of an equal-arm bridge (100 ohms in each arm) when the resistance of one of the arms is changed 2 ohms. The normal frequency swing of the converter is set at 5000 cps, which permits operation of the automatic analyzer at any point between 500 and 6500 cps.

This flexibility of frequency shift in the analyzer affords primarily a safety factor to be used in case the basic zero of the converter drifts from its set frequency. Should a drift of the basic frequency occur, there is available on the analyzer a correcting adjustment which permits the charts to be plotted on the basis of 5000 cps change equal to full scale, regardless of whether the 5000 cps is between 500 and 5500 or between 1500 and 6500. The charted output of two dummy check gages in the airplane serves as an indication of, and as a correction for, both frequency drift and frequency spread. In case of a change in frequency spread between the two dummy check gages, there is available on the analyzer another adjustment to hold its calibration to the correct spread as indicated by the plotted output of the check gages.

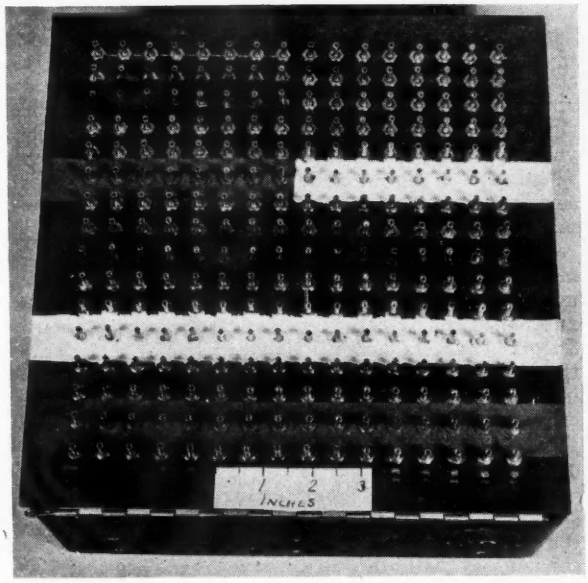


Fig. 11—Plug-and-jack terminal board

In developing the scanning switch, various types of wiping contacts were

Speed changes in scanning are accomplished by electrical control and by change gears outside the switch box. The present switch contains 72 contact point sets, mounted in three banks of 24 each. Any one of the banks may be scanned continuously, or two or three banks may be scanned in succession.

In addition to scanning the pickups,

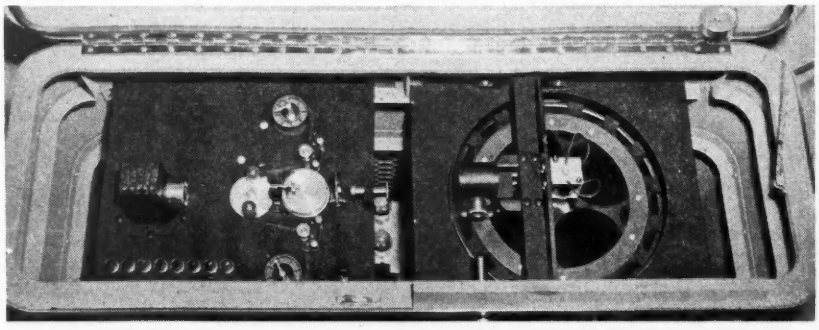


Fig. 12—The automatic optical film analyzer

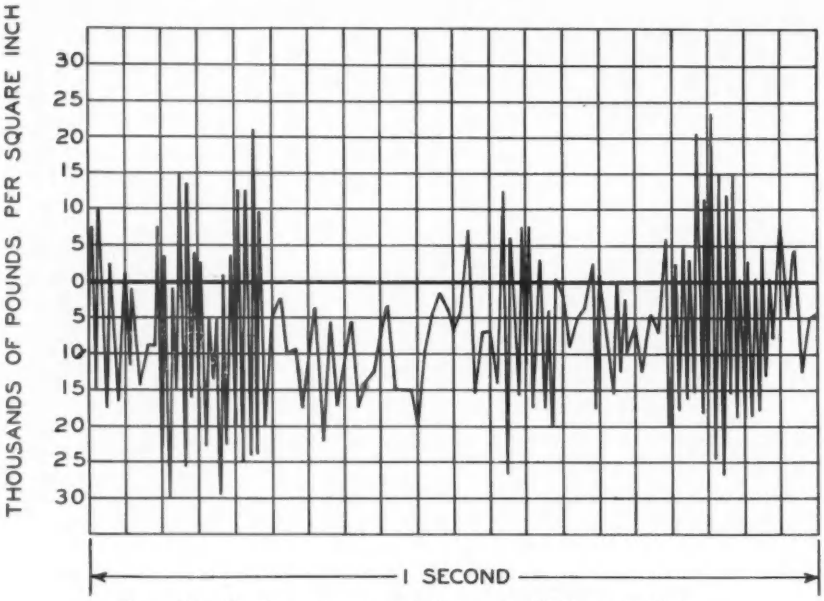


Fig. 13—Strain-gage record for a buffeting condition

the switch, by means of additional gear trains and contact points, stops the signal from the converter during intervals between instrument readings (Fig. 8). This unmodulated section serves as a division between instruments during analysis, while on film recordings the black part of the unmodulated track is used as a framing mark in the analyzer and operates an automatic photo-cell framing device. Special contacts are provided to open the signal line from the converter during the time a tachometer signal is coming through. All contact points of the switch are wired to one side of a plug-and-jack terminal board, Fig. 11.

The conversion from changes of stimuli to changes of frequency in the converter unit in the airplane can be considered instantaneous, because the entire process is electronic. The speeds of decoding these frequencies and plotting them on charts are controlled by the inertia of the mechanical devices used. While the amplitudes in flight can be taken as fast as 100 per sec, the automatic analysis and plotting on separate charts of the recording made at this speed require 3 or more seconds per instrument. The optical analyzer consists of a means for projecting successively each instrument frequency, Fig. 8, as recorded, through a scanning mat to a photo cell. The term "instrument frequency" refers to one group of striations. The scanning mat, mounted on a revolving drum, Fig. 12, consists of a transparent film on which is recorded a continuous sound track which varies from 500 cps to 6500 cps. As the scanning image passes across the stationary image of the instrument frequency, a low amplitude modulation of the light beam is produced. At the moment the scanning frequency matches the projected instrument frequency, the two images are superimposed and thus pass the maximum amount of light. They next become adjacent to each other and shut off all of the light. This alternating sequence produces a surge of high-amplitude light modulation which, through the phototube and associated circuits, operates the graphic charting equipment. The sequence of charting operations, automatically performed by the analyzer, is as follows:

1. Without contact, the recording pen moves across the chart in relation to the rotation of the scanning mat.
2. Matching surge causes the pen to strike the paper.
3. Pen returns to zero.
4. Endless chart belt moves ahead to the chart for the next instrument.
5. Film moves ahead to the next instrument frequency.
6. Cycle starts over again when steps 4 and 5 are completed. To prevent premature operation of any part of the analyzer, interlocking relays are provided.

If 72 instruments are scanned in the airplane, an endless belt of 72 charts is used in the pen recorder.* After the decoding is completed, the charts are cut apart to give a separate chart for each instrument with all charts covering the same flight time element.

When the radio recorder is operated at speeds not exceeding the limit of the paper recording equipment used, direct paper charts of the instrument readings can be made at the ground station as they are scanned in the airplane. The Easterline-Angus graphic recorder used with the analyzer can be used for plotting the instrument readings, provided they are scanned at a rate of not more than one reading per second, which is the time lag of the recording pen. In this case decoding is accomplished by means of electronic circuits. The transmitted instrument frequencies are fed from the radio receiver into a limiter circuit which keeps the amplitude of the signal constant during input variations of from 15 to 25 volts. The signal is then fed to a discriminator circuit which produces a direct current varying in proportion to instrument frequency. This direct current is used to operate the meter element of the graphic pen.

In addition to the electronic analysis, a disc record is cut as the signals are received. The recording serves as a permanent record of the flight and a safety record in case of failure of the graphic instruments. A standard commercial disc recorder is used, with changes made to insure freedom from recording noise and speed variations. Crystal units have been substituted for magnetic. The records are cut at 33 1/3 rpm, with 130-140 lines per in.

The disc recorder is mounted on a cabinet containing the limiter circuit, the discriminator, amplifier, speaker, amplitude indicator and amplitude control. Jacks are provided for input and output to various recorders. A microphone is provided for recording identification and other data desired on the record to complement the instrument signals. The records can be played back and recorded on film for analysis by the optical analyzer or the graphic recorders.

An intervalometer is used in connection with the recorders whenever it is desirable to record instrument readings at definite time intervals. In climb studies, for instance, one set of readings could be made every 30 sec. The intervalometer is controlled by cams and selector switches, and is designed to start and stop the recorders and to withhold the signal until the proper recording speed is reached. It is also equipped with an override button, to permit continuous recording whenever desired.

The Vultee radio recorder is extremely flexible in its operation. All leads from the pickups are brought in to a terminal board at the scanning switch, where any desired continuity can be set up. This is exemplified by dive and pullout studies, where acceleration plus the added effects of air bumps is the important factor. The scanning can be set up to read acceleration 50 times in a second, in addition to 50 other pickups in the same second. Or the pilot may be provided with a selector switch with which he can select any pickup at will and obtain a continuous record of that pickup. Such tests have been made at Vultee to record loads on a structural member that had been failing in flight. The plotted curve of the loads on this member during buffeting encountered in a pullout is shown in Fig. 13. The average load of approximately 7000 psi had been anticipated, but the load reversals of a magnitude of over 20,000 psi in tension and 30,000 psi in compression at a rate of 6000 cpm were entirely unexpected. Previously it had been impossible in the laboratory to reproduce failures in this member, but by applying load reversals as revealed by the flight recorder, laboratory reproductions of flight failures were accomplished.

Mosquito Legs

Equipped with Rubber Pack to

Absorb Shock

AMONG the distinctive features in the construction of the British de Havilland warplane, which was described in the June 15 issue of AUTOMOTIVE *and* AVIATION INDUSTRIES, is the use of rubber alone as the shock absorbing medium in the compression struts of the undercarriage. Although the use of rubber in this connection is by no means unique, it is distinctly unconventional nowadays in an aircraft of a size approaching that of the Mosquito, for it need hardly be recalled that except in the case of light airplanes, such as primary trainers, the oleo-pneumatic type of undercarriage is practically universal.

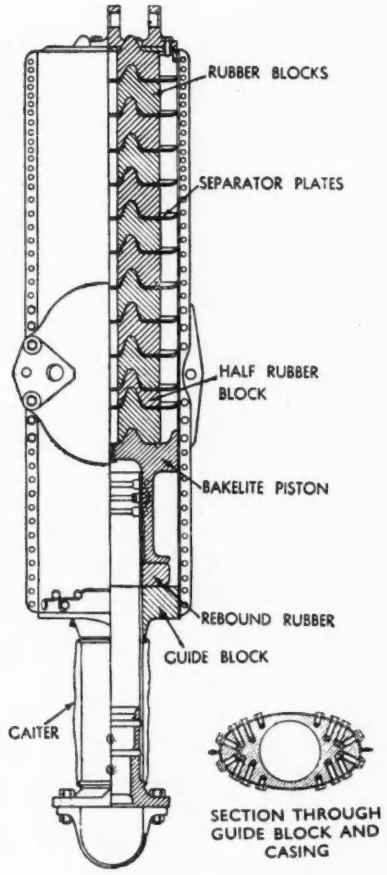
Several advantages are claimed for the rubber compression leg. For one thing, the large amount of high-precision machining that is necessary on the tubes of an oleo-pneumatic unit is entirely eliminated, while servicing is greatly simplified by the fact that there are no joints to be kept leakproof under high pressure.

As shown in the accompanying drawing (reproduced from *Aircraft Production* (London)) simplicity is carried to a fine point in the construction of the Mosquito undercarriage leg. The casing is divided on the vertical center line, each half consisting of a semi-elliptical pressing, formed from 16 S.Q.G. DTD 124 steel complete with joint flanges. The operative details comprise, first, a piston tube connected at the lower end directly to the wheel axle and having attached to its upper end an elliptical piston of laminated, fabric-reinforced Bakelite material, which moves inside the casing. A guide block, of the same Bakelite material, is secured by screws in the lower end of the casing to serve as a guide and bearing for the piston tube. The rubber compression element consists of a pack of 12 units, 11 full blocks and one half-block.

Each rubber block is molded with two locating lobes or dowels projecting from its upper face and two corresponding recesses in its lower face, the whole pack, therefore, being self-aligning when assembled. Between the blocks are aluminum spacers with edges flanged to fit the inside of the casing. They are pierced to accommodate the lobes in each block, these protruding through the spacers into the recesses of the blocks above. A rebound rubber block is mounted on the piston tube between the piston and the guide block.

The upper end of the casing is closed by a cap rivet-welded and seam-welded to the top of the casing. A flat mounting surface is made by disk-grinding the top of the cap, which is then drilled for attachment of the leg pivot bracket. Brackets for the radius rods and diagonal bracing of the leg are secured to the casing by circular strap plates.

This construction is said to have given very satisfactory results. When resiliency decreases after extended periods of use, a full rubber block is fitted in place of the original half block.



Part-sectional view of the Mosquito under-carriage leg. Inset shows how the Bakelite guide block of the piston tube is secured to the casing.

Knotty Problems Ahead in

John W. Scoville, **Chrysler Statistician, Discusses Automobile Production and Price Regulation, Government Policy and Other Factors Affecting the National Economy.**

ALTHOUGH some sales-minded executives are anticipating postwar consumer markets that will make necessary the manufacture of 6,000,000 passenger cars in a single year in order to help fill the huge demand, John W. Scoville, chief statistician for Chrysler Corp., does not altogether share their enthusiasm. He believes it would be much healthier both for the economy of the United States and the automobile industry if that pent-up demand, engendered by the cessation of motor car manufacture two months after Pearl Harbor, were spread over a five- or six-year period.

Because no passenger cars have been made for civilian use since Feb. 10, 1942, Scoville foresees a deficiency of 7,000,000 passenger cars by 1944. At the normal rate of replacement, this demand may jump to 10,000,000 cars by 1945. If the industry found it desirable, it undoubtedly could build up to a capacity of 6,000,000 cars annually for the postwar period. However, about three years' production at that rate would take care of pent-up demand and normal obsolescence, making a severe depression in the industry likely after three or four years.

Peak production year in the automobile industry's history was 1929, when 4,587,400 passenger cars were manufactured in the U. S. Second to that was 1937 with output of 3,915,889 cars, followed by 1941 with completion of 3,744,300 cars. Average annual passen-

Postwar Controls

IT seems to be accepted generally that during the transition to peacetime normalcy, some degree of Government regulation will be necessary both over the reconversion of industrial plants now engaged in turning out war goods and also over the production and distribution of certain civilian products for a short time. At present Federal committees and agencies of the Legislative and Executive branches are engaged in postwar planning, but in order that a clarified policy can be made available to industry, these various plans will have to be coordinated by Congressional action and the procedure defined for administering a definite plan.

The conversion to war production was hurried with the attendant evils of waste and inefficiency that could not survive in a sound peacetime economy. As the problem of the transitional period will be chiefly industrial, management is best equipped to deal with it. Just as soon as the Government can supply a broad policy for guidance, then industry will go ahead and do the job efficiently. Recently the Directors of National Association of Manufacturers approved the following recommendations for the termination of wartime controls:

Wartime controls should be entirely eliminated as soon as practicable after hostilities cease. Such action would stimulate free enterprise, the restoration of competition and the provision of jobs.

In considering the elimination or temporary continuance of wartime controls we make certain assumptions:

(1) The war will not end in all theatres at the same time. As a result we will have two conversion periods, since some plants could probably be turned to civilian production after the ending of hostilities with one of the nation's major foes. It follows that it might be possible either to eliminate, or at least to relax, some controls before hostilities in all fields are ended.

(2) That the administration of existing wartime controls will be improved. At the present time such controls are progressively breaking down, but this trend can and should be reversed. Such controls cannot be even reasonably successful unless experienced and able administrators are given adequate responsibility and authority in the administration of such controls, both now and in the postwar period.

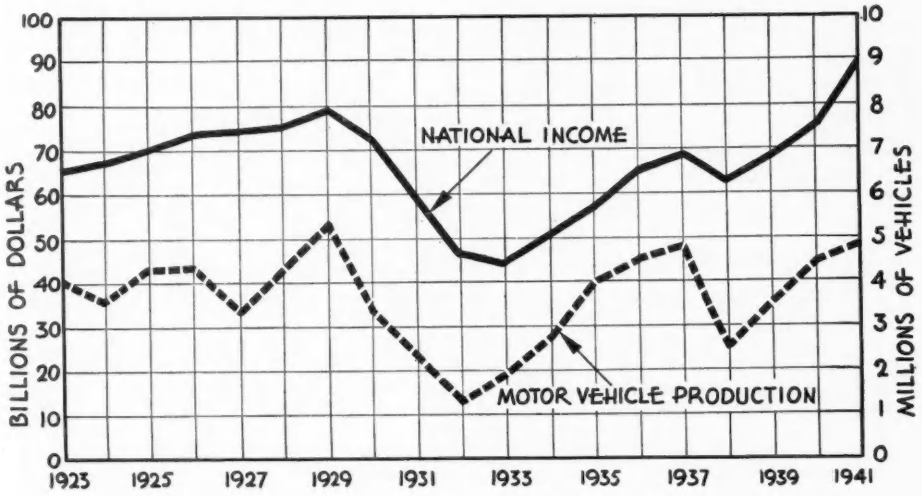
(3) If wartime controls over prices, rationing and materials are immediately ended when military needs no longer require such control the result would very likely be a rush of purchasers which, because of inadequate supplies, would lead to a serious inflation of prices to consumers and would handicap small business enterprises.

On the basis of these assumptions we believe that it would be inadvisable to urge immediate ending of all controls with the ending of hostilities. It is quite possible, moreover, that different controls should be ended at different times, depending on foreign sources of supply, domestic productive capacity, length of conversion in different industries, emergency relief demands from abroad, and stock-piles when hostilities cease. While for this reason it would be inadvisable to fix definite calendar dates for termination of controls extension of existing controls should be only for short periods of time.

the Postwar Car Market

Trend of National Income and Motor Vehicle Production in United States

How motor vehicle production has paralleled national income in this country for many years is shown in this chart. One exception is the decline in the 1927 production, which was due to the Ford Motor Co. not being in production during the retooling of its plants for the Model A car.



Source of National Income data—National Industrial Conference Board. Motor Vehicle Production includes passenger cars, trucks and buses.

By E. L. Warner, Jr.

ger car production for the 10 years from 1921 through 1930 was 3,219,610 units. This was a decade of prosperity. It was followed by a decade marked by the severest depression in the nation's history, with the yearly production average slumping to 2,625,778 cars. Average annual output in U. S. plants for the 20-year period ending with 1941 was 3,036,506 passenger cars.

Scoville figures the industry could reconvert to an annual capacity of 4,000,000 passenger cars without undue strain or economic waste. He believes that each manufacturer should realize that it is to his best interests to expand his production facilities only moderately after peace comes and reconversion is under way. He asserts the manufacturer who increases his annual capacity greatly, eventually will find an unneeded excess of capacity and idle capital tied up in new machinery and materials when the inevitable decline takes place. The company that expands for the immediate postwar market will indulge in social waste of material and manpower if the new equipment is intended only to make up the two or three-year deficit in new automobiles created by the war. It also would be uneconomic to amortize this expansion over only a two or three-year span.

Past production booms in the industry have been followed by sharp recessions. The inflation following World War I carried 1920 passenger car production up to 1,905,560 units, but it dropped 23 per cent the next year to 1,468,067 units. Peak of the prosperous 'twenties was reached in 1929 when output jumped to 4,587,400 vehicles, but then it declined precipitately by 39 per cent to 2,784,745 units in 1930. The 1937 boom that brought with it an output of 3,915,889 passenger cars was followed by one of the most severe recessions, with only 2,000,985 vehicles produced in 1938, a drop of 49 per cent. These sudden changes in the industry's tempo tend to unstabilize its economy and unduly disrupt its labor, material and supply problems.

But how to equate postwar supply and demand for passenger cars? Scoville is opposed to any continuance of motor vehicle rationing by the Govern-

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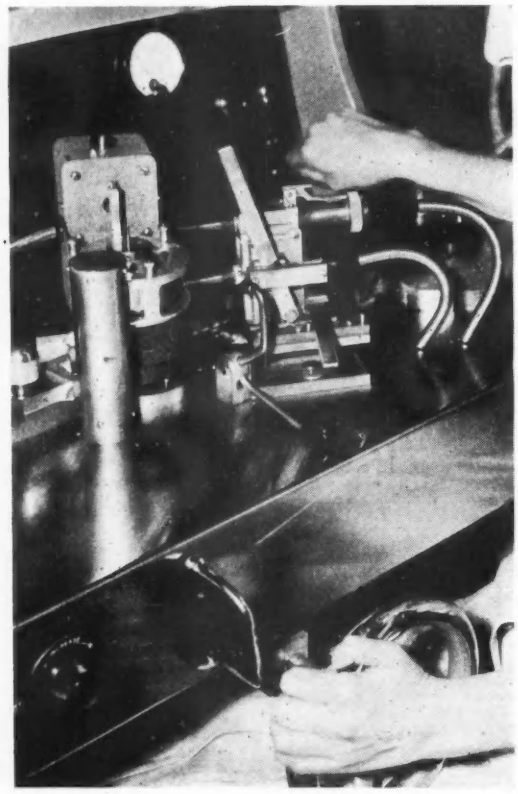
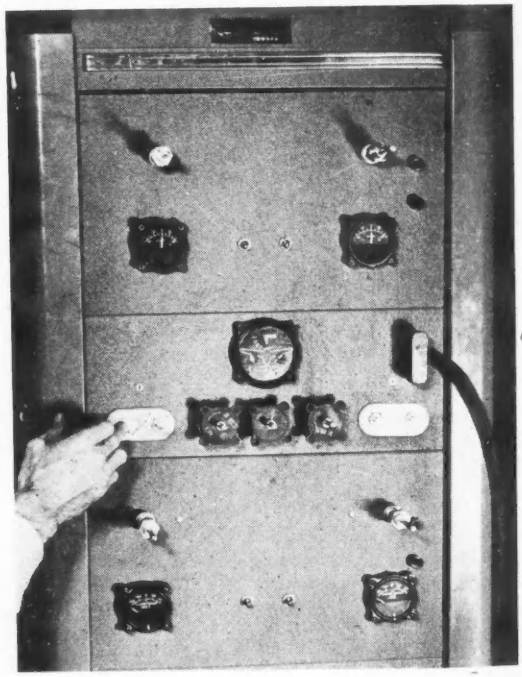
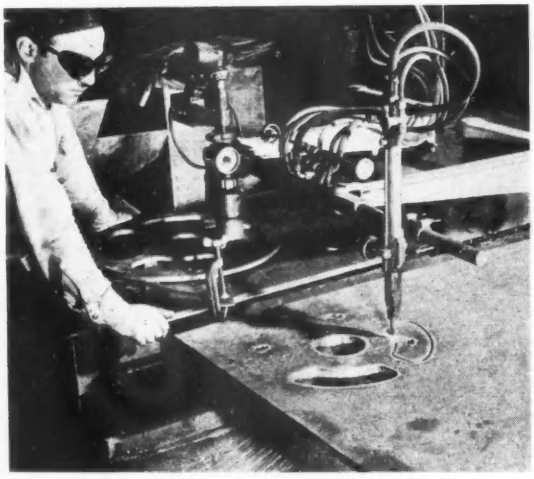
Short



This automatic electrical device, which was developed by engineers of the Eclipse-Pioneer Division of the Bendix Aviation Corp. for balance testing of gyroscope rotors, performs in minutes a precision testing job that formerly required three hours by hand and releases skilled technicians for important research and development work. It includes a "sparking eye" which scans a gyro-rotor spinning at top speed and marks through an electric current the points of unbalance. Simultaneously the exact amount of weight necessary to be drilled from the rotor to bring it in to balance is recorded.

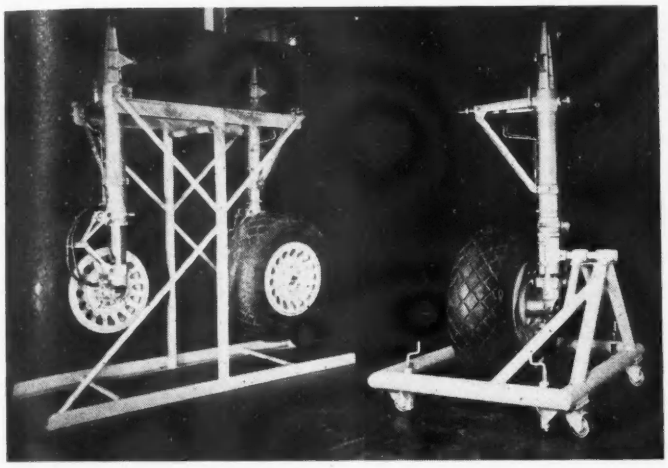


To replace the former procedure of testing accessories after their installation in an airplane, special equipment and fixtures have been developed and are now in use at the Missouri plant of the Airplane Division of the Curtiss-Wright Corp. for testing them before they are installed in the Commando C-46 military transports now being built there. This new system of pre-setting the accessories to their correct limits and at the same time checking them for defects has resulted in a big saving of time, costs and materials. Each fixture consists of a cabinet and appropriate panels fitted with the necessary equipment, gages, or electrical instruments to perform a check on one accessory unit or related units. In the accompanying photo is shown the panel that was developed to test flap and landing gear position transmitters, indicating heads and also temperature indicators. Voltage regulators, generator relays, propeller governors, booster coils, fuel level gages and other accessories are pre-set and a large variety of electrical and hydraulic mechanisms are checked with the aid of special panels.

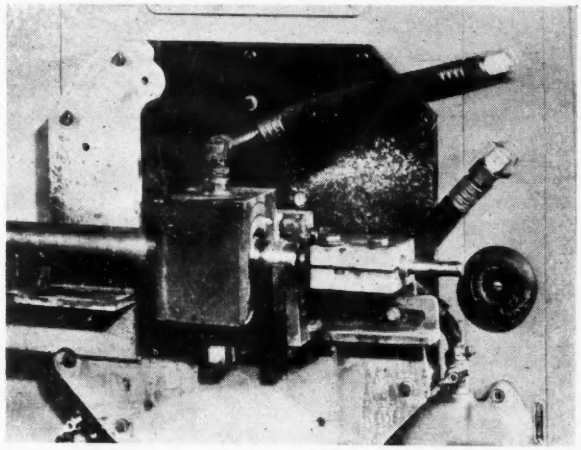


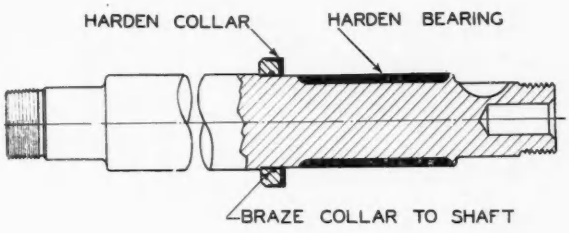
A manufacturer recently needed a small quantity of large gears quickly so he turned to flame cutting to make the gear blanks, 4 in. thick and 20 in. diam. from a large slab of medium carbon steel. Five piercing starts were required on each gear to provide four lightening and the center shaft opening. Piercing was done by first routing out shallow craters in the center of each waste section with a hand cutting torch, then burning these holes completely through with an oxygen lance. Cutting of the blank then proceeded using an Airco planograph with a magnetic tracing head following the outlines of the steel template. The 4-in. deep cuts were made with a Style 124 No. 6 tip, operating at 55 lb. oxygen pressure and 3 lb. acetylene. Speed of cutting was 7 in. per min. A flame-cut hub was welded to the gear blank before machining the latter.

Cuts

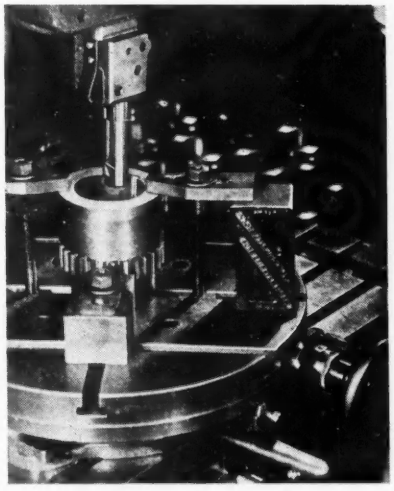


(The Industrial Engineering Dept. of the Northrop Aircraft Co. has designed this dolly (Right view) for installing the landing gear on a plane in a quick, safe manner. Two men can make the installation as compared with six to eight men formerly. The gear is fully assembled and clamped in the sleeve mounted on a shaft which rotates in solid journal boxes. Balancing the assembly at the center of gravity allows the strut to be swung through an arc of 180 deg. with the pressure of one finger. The installation dolly is rolled under the ship, the strut swung into the proper positoin and the jack screws used to bring holes in line. The pins are then inserted. The dolly is then removed. Another feature is that the dolly is designed so that it can be used to make a left or right landing gear installation. The other photo shows the rack used to hold the landing gear prior to transfer to the dolly.

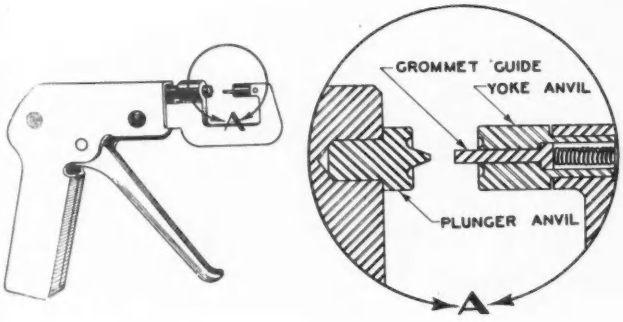




Changing the design of a Tocco induction fixture made possible a rapid heat treating operation on balancer shafts for Diesel engines used in Army tanks. Originally the bearing end was turned down to size from bar stock having the diameter of the collar which forms the thrust face at the end of the shaft. Now the collar is turned out separately on a screw machine, then positioned on the shaft, and the hardening of the two bearing surfaces and brazing of the collar to the shaft is accomplished in a 41-second cyle.

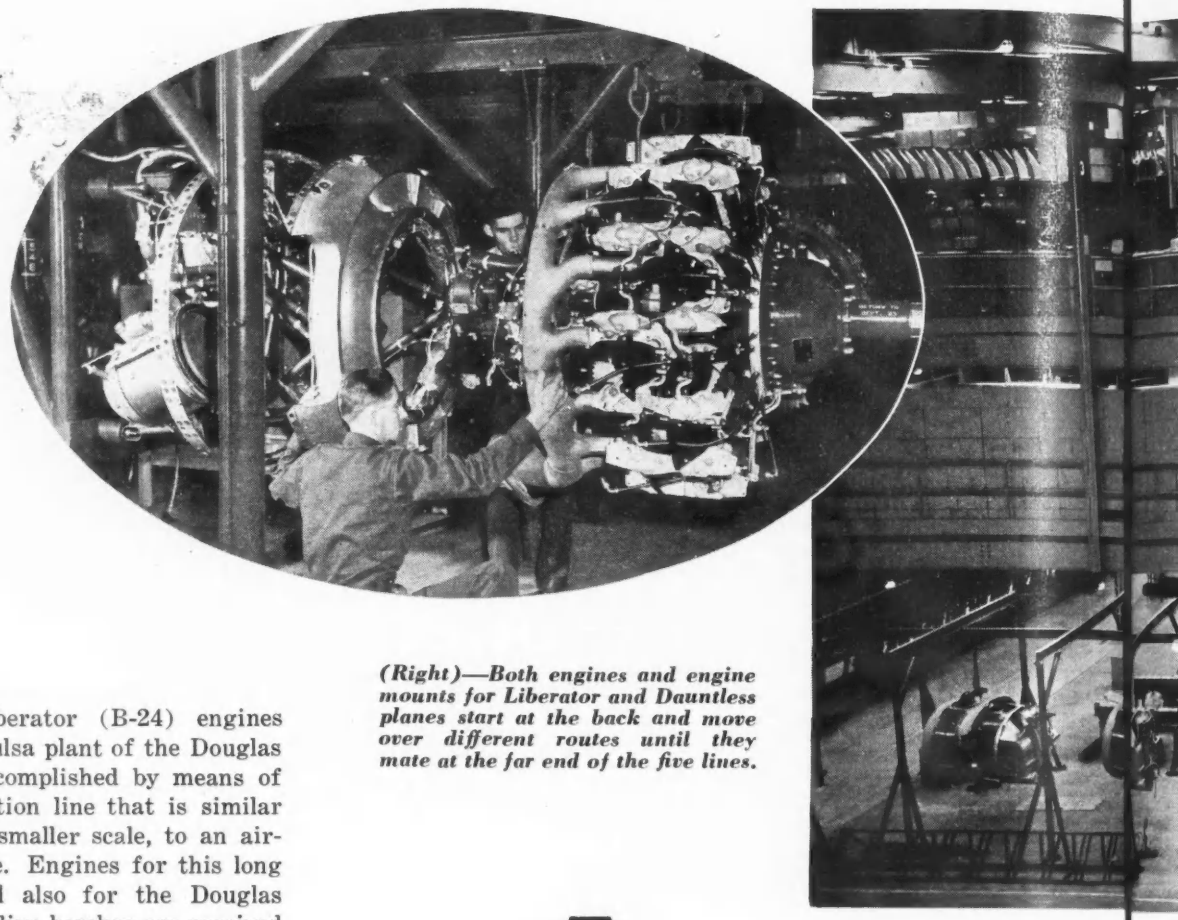


To cut a tapered keyway in more than 100 engine sleeve reverse gears it was found practical to do this job on a milling machine on which a Slotmaster had been installed by improvising a fixture on a Gordon rotary table, by means of a plug with a locating finger and clamps. The work was held to limits of two thousandths—the dimensions of the keyway being 5/16 in. wide and 3/16 in. deep . . . A standard slotter or shaper would have required an expensive tool room fixture.



To facilitate the installation of 3/32 in. and 1/8 in. grommets, Vego engineers made this hand tool consisting of a small C-type yoke welded onto a standard 3H safety gun. There are two anvils, or dies. One is the yoke, or female anvil; the other is the plunger, or male anvil. The yoke anvil has a grommet guide which is depressed when the plunger anvil contacts it. The plunger is actuated by compressing the handle of the gun. This action brings the plunger anvil in contact with the grommet depressing it against the yoke anvil and squeezing it. The outstanding features of this tool consist of its light, portable, and inexpensive characteristics. It is ideal for use on the production line where speed is a dominating factor.

(Oval) — An engine, which has been prepared on one line, mates with an engine mount which has been prepared on another line, both in the Engine Preparation Department of the Tulsa plant.

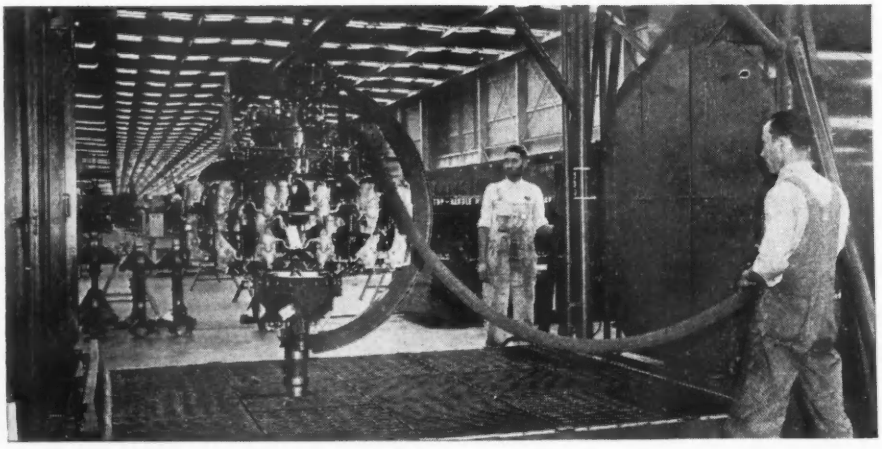


(Right)—Both engines and engine mounts for Liberator and Dauntless planes start at the back and move over different routes until they mate at the far end of the five lines.

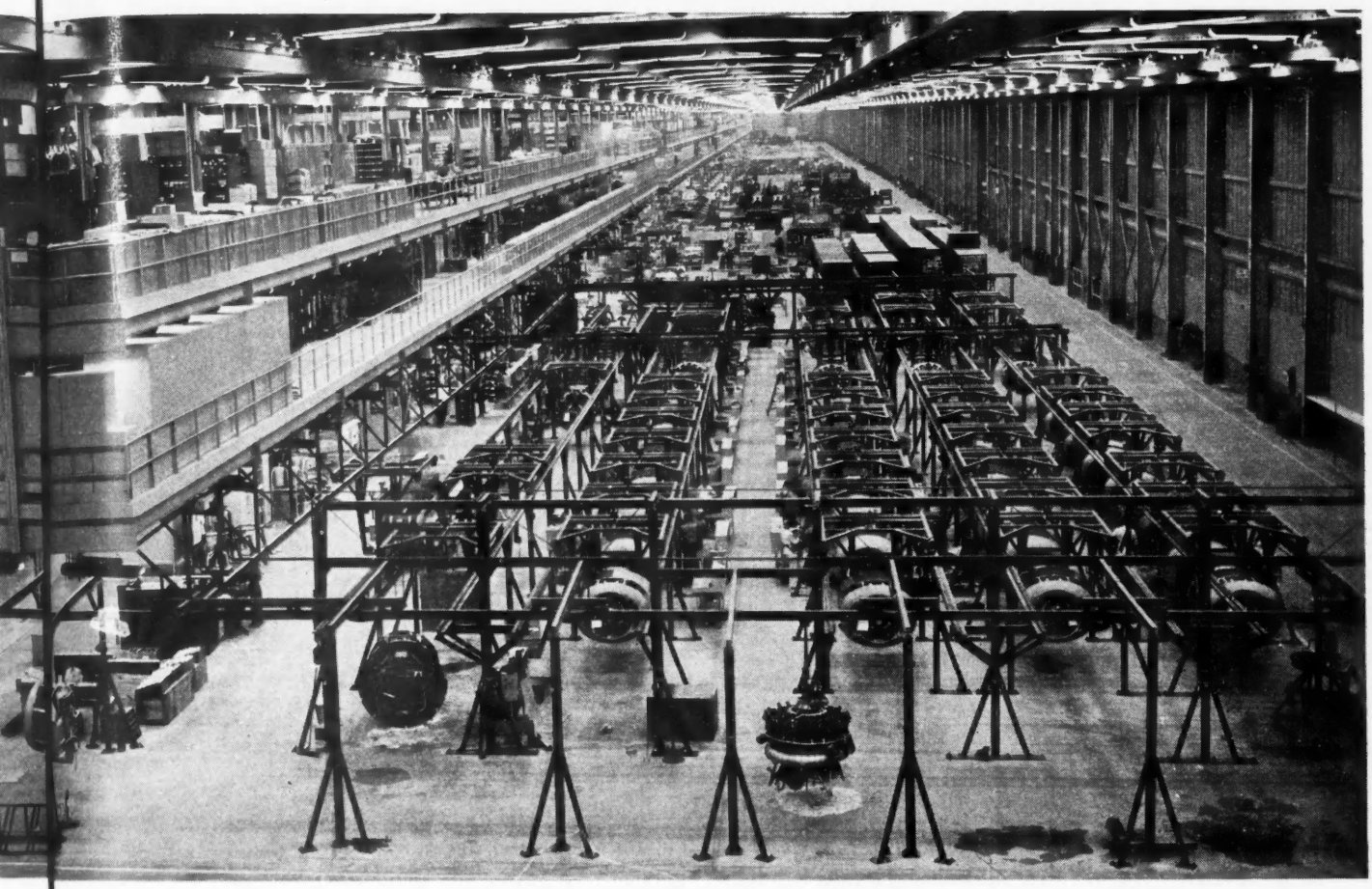
Assembly

HANDLING Liberator (B-24) engines efficiently at the Tulsa plant of the Douglas Aircraft Co. is accomplished by means of an engine preparation line that is similar in principle, on a smaller scale, to an airplane assembly line. Engines for this long range bomber and also for the Douglas Dauntless (A-24) dive bomber are received from the makers in shipping boxes and when each engine is removed from its box, the shipping plate by which it was attached is left intact. A hub carrying a lifting eye is screwed to the end of the propeller shaft, and by means of a transfer plate, the engine is moved to a carrier of the swivel type slung from a two-track overhead trolley. This overhead trolley and a supplementary monorail hoist system is the secret of the department's operation. The engine enters the department suspended from overhead, is moved overhead through all the work stations, and is carried overhead to the assembly line for mounting on the plane.

The heavy grease, with which some engines are coated to protect them during shipment, must be removed before any other work is done. As it is so viscous that little will drain off at atmospheric temperatures, heating is necessary. Heating by ordinary methods to the required temperature of 140-150 F would take too much precious time, so the engine gets a heat bath in a booth banked on two sides with infrared ray lamps, which may be adjusted to accommodate any size of engine. The engine stays in the booth 80 min, after which it is removed to the outside where an air hose is connected to the cover plate and to a nearby air line provided with a water trap to remove moisture. The dry air is forced through the cylinders to blow the remaining heated grease out through the spark



Innards of this Buick-built engine get a thorough cleaning and drying from high pressure air which drives out any protective grease that may remain.



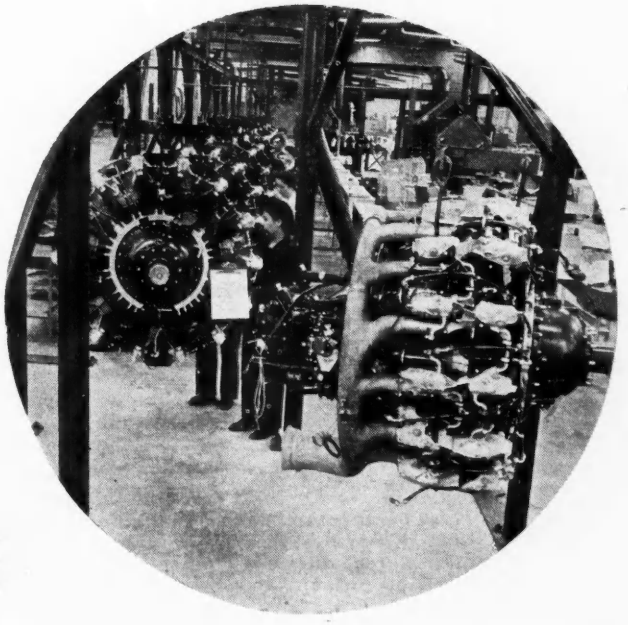
Line Methods

Used at Douglas Plant to Prepare Engines for Installation Bombers

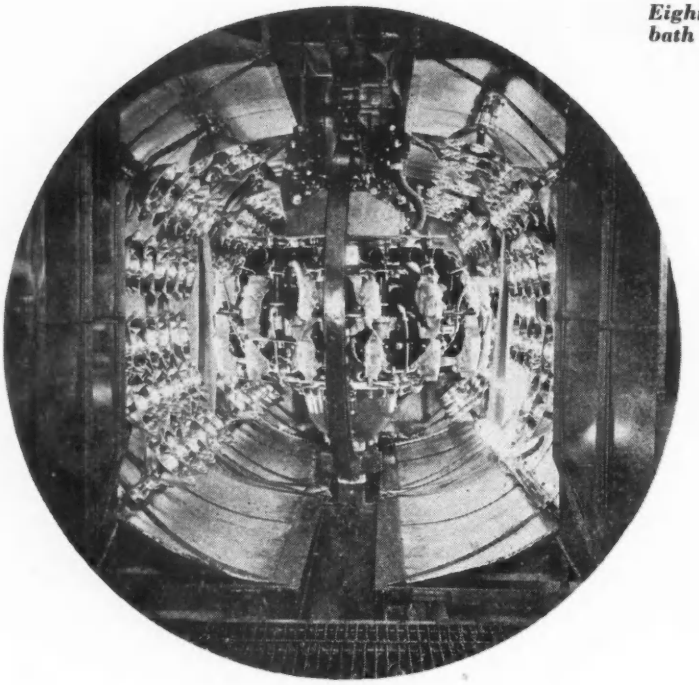
By F. H. Hillman,
Plant Superintendent,
Tulsa Plant, Douglas Aircraft Co., Inc.

plug holes. Then the engine is given another bath, this time in a shower booth where solvent is sprayed on the outside of the engine at the rate of 350 gpm. The solvent is shut off and air blasts are turned on for 10 min to complete the engine cleaning. Engine manufacturers have begun recently to omit the heavy grease and to protect the engines instead with Pliofilm bags, which eliminate the entire cleaning process.

Engines leaving the spray booth are returned to flight position by attaching a cross yoke to the shipping plate and lowering the nose with an electric hoist. A sling carried in the overhead double-track trolley is attached to the engine at three points.



In the engine build-up assembly line at the Tulsa plant, all work is done which can be prior to the time that the engines are placed on their mounts.



Eighty minutes in this infra-red ray bath melts the viscous grease so that it drains off freely.

This supports the engine at a slight tilt with nose down. The nose automatically pulls up level as parts and accessories are added.

The engine is moved by hand through seven work stations which constitute the build-up line, but the preparation line is so built that they may be moved by power if that is thought desirable. On this line and all others, electricity and compressed air outlets are provided at each work station, and a row of work tables parallels the line on either side. Work done on this line includes installation of eight flexible engine-mount connections by use of a jig to position them accurately. Baffles, collector rings, manifolds, propeller governor line brackets and other sub-assemblies are put into place. At the end of this section of the line, the conveyor takes the engine on a right-angle turn and across to one of five engine mount lines—four for the B-24 engines and one for the A-24 engines.

Floor area between the engine build-up line and the first mount line is occupied by benches devoted to sub-assembly work, as much as possible of which is done on the benches rather than on the lines. Books with printed and photographic instructions show every step of the 600 sub-assemblies so that inexperienced operators learn their duties quickly. A special carrier rolling on a four-wheel trolley suspended from two overhead tracks holds engine mounts both before and after the engine is added.

The oil tank assembly, the oil cooler, the inner cooler and the diaphragm are installed on the mount build-up line, adjacent to which are tool racks and work tables, which place all needed material within easy reach of assemblers. The mount and the engine meet at the correct height at the mating points of the two lines, and a vertical adjustment of the carrier facilitates transfer of the engine from its own trolley to the mount. The freed engine trolleys roll automatically back to the starting point to begin anew.

Engines and mounts go together through ten stations for work which cannot be done on either of them separately. Along this final part of the line are carburetor, flap ring, crank extension and air duct installations. Electric connections, fuel lines, oil lines and vacuum lines are hooked up. Cowling is fitted, stenciled with the engine number and removed to a dolly where all its sections for a single ship are carried to the final assembly line to be put back into place after the engines are mounted on the ships.

A monorail hoist cuts across all five preparation lines at the final station and transfers the combined engine and mount by a sling to the monorail conveyor. Turntables switch the assemblies to a right angle monorail along which they are rolled. When over a floor dolly, they are lowered, unhooked and carried to the final airplane assembly line. The same monorail is used to return the engine mount carriers back to the beginning of the mount build-up line for another cycle.

(*Turn to page* 87, *please*)

First step in the Engine Preparation Department at the Tulsa plant is the removal of the Buick-built Pratt & Whitney engines from their crates, after which they are placed on swivel type carriers slung from a two-track overhead trolley. One of the carriers can be seen at the rear in the photo.

Airbriefs

By Henry Lowe Brownback

Controllable Pitch Props

The airplane has now grown up to the point where makeshifts are no longer acceptable even in smaller units. The automobile went through the makeshift stage of transmission and final drives, and I think most of us can remember the time, just before the last war, when the market was flooded with bathtub-like vehicles called cycle cars which were propelled by motorcycle engines through a more or less haphazard gear changing apparatus and Vee-belt final drives. From the publicity which accompanied the launching of the cycle car campaign one would have imagined that they would be sold by the millions but because they were a makeshift, comparatively few of them were built. Another boom was the automobile house trailer, and we do not have to look back very far to remember the prediction that one half of all the Americans would be living in trailers and moving from one place to another.

Tomorrow's small airplane cannot contain makeshifts and like the large airplane will need some sort of a "gear shift." This can be in the form of a controllable pitch propeller or a variable speed gear between the engine and the propeller. So far most controllable pitch propellers are heavy and expensive. However, this does not mean that a good light airplane propeller embodying controllable pitch features may not be made. The other possibility of using a variable speed gear between the engine and the propeller also has possibilities, especially in view of the fact that in order to get a maximum efficiency the high speed airplane engine must be geared down at the propeller and if a gear is being used it may be that the use of a two-speed gear reduction instead of the single speed gear reduction would be both lighter and cheaper than a gear reduction plus a controllable pitch "prop."

Air Freight

One of the things which everyone in the aviation industry must guard against are the exaggerated statements which have hurt the business in the past. Happily few of these have come directly from aviation experts and mostly from enthusiasts with little no real knowledge or from newspaper reporters who write a page article from a ten-word cable. Lately much has been said about the future of air freight and predictions have been made on about everything up to and including aerial locomotives towing long glider trains loaded with everything up to and including elephants. Common sense will show the possibilities of air freight and its limitations. The advantages of aviation, whether it be a small single passenger plane or a giant airliner, are first and foremost speed. Secondly, ability to cross stretches of water and mountain ranges, etc., with a minimum loss of time and without the building of expensive road beds. Third, the avoidance of crowded traffic. Speed whether it be on land, on water, or in the air, is dependent, all things being called, on the expenditure of relatively large amounts of power and is for this reason costly. As the size of airplanes increases it is going to cost less per pound mile to transport passengers or goods than it does with our present size airplanes for the same reason that in order to make the same speed as the Normandie makes with about 1 hp per ton a small boat must apply 1 hp for every 20 lb. However, at that it costs far more to carry merchandise across the ocean on the Normandie than on a small freighter. If the need for the merchandise is great enough to make it worthwhile paying the difference, and if the merchandise is so perishable that rapid transportation is absolutely necessary, or so valuable that the interest upon the money involved will more than pay the difference in freight then the rapid means of transportation will get the business. If we were sending 10,000 airplane motor connecting rod bearings across the ocean for use on production lines, the chances are we would send them by ocean freight in order to get the low rate. On the other hand, if we are sitting in France and England with a burned out rod bearing and have to get one from Detroit in a hurry, we are more than willing to pay the increased cost of air freight. In Europe where every cent counted before the war they used to ship perishable fresh sardines from Brittainy to Paris by air so as not to let the fish spoil, and the Englishmen living on the Continent read his London morning newspaper which had come over on the paper plane. Keeping all of these factors in mind, together with the possible increase in airplane size and efficiency as the art progresses, we can make a safe and sane prediction upon which to base investment in aviation freight and passenger carrying facilities. The talk that this will supplant steam ships and railroads, is for the most part, absurd and it is equally absurd to say that they will not greatly complement these other services.

Glass and Plastic

The future airplane and automobile are going to contain a great many articles made of formed glass and plastics and some of these are going to be most interesting. I am at present driving a motor car built in Europe about the outbreak of the war and one of its greatest comforts is a windshield tinted at just enough to kill road glare and yet not enough to make night driving hazardous. Your new airplane and motor car are going to contain large transparent areas made of plastic or glass, but many of these will probably be made of materials which will permit you to see out of them and yet not be sunburned, as the glass and the plastic will absorb the burning rays. Experiments were being carried on in Europe and very probably in this country with the use of a glass which will only pass light in one direction. That is you would be able to sit in a car and look out and see everything, although the inside of the car would be in comparative darkness and invisible from the outside. In fact, there was considerable flurry in Europe in police circles about the use of this type of glass which would prevent officers of the law from observing the riders in the vehicles. There various feature developments are going to be especially valuable in the case of aviation where high flying will carry one above the clouds and in the blind rays of the sun over a long period of time.

Radio

While we are looking into the future we must envisage the use of radio, both two-way telephone and direction finder, in even the smallest and most modest airplanes. This is going to create a great market for simple and cheap radio sets of this type and offers a wide field for inventive research. Such sets will also certainly be found after the war on most motor boats as a safety measure and, in fact, I expect to see them required on all cabin boats and other boats going out of sight of land, and a part of the equipment of the modern automobile. With such sets anybody traveling by land, sea, or air can call radio stations located all over the country which would transfer his call over the telephone lines, thus permitting connections at all times. I expect this to be one of the very early developments to follow the war.

By E. A. Allcut

Producer Gas for

VERTICAL draft producers have relatively deep fuel beds and low air velocities, due to the necessity of protecting the grate and lining from high temperatures and clinker deposits. Horizontal (cross) draft producers have small fire volumes and must necessarily have higher temperatures to produce good gas. It has been shown that at 2400 F the conversion of CO_2 into CO_1, and of steam and carbon into CO and H_2 is practically complete in three seconds. If the temperature is reduced to 1830 F the conversions, in the same time, are 6 and 15 per cent complete, respectively. In some cross-draft producers, temperatures as high as 3000 F are required, to give very rapid and complete production of carbon monoxide. As there is no grate in the cross-draft type, the clinker forms a compact, pan-shaped mass, away from the air and gas connections. The high-temperature combustion zone is small and compact, but the exit temperature of the gas is high (Fig. 5). So far, it has not been considered practicable to heat the incoming air at the expense of the outgoing gas, the return not being commensurate with the extra cost and complication of the apparatus. Such regeneration is provided in some vertical draft producers (Fig. 4), but is of doubtful value. Tests made by the author in 1911 showed no considerable advantage when the air was heated to 300 F. One type of producer (Koela) embodies a combination of the updraft and cross-draft principles, and also includes regeneration.

Experiments made on a cross-draft producer with varying water supply showed that gas generated without water injection was 12 per cent poorer than the best gas obtainable, corresponding to a decrease of six per cent or more in available engine power. Tests made on an Australian emergency (A E) producer, based on the British (B E) design, gave producer efficiencies of 76.4 to 74.1 per cent at engine speeds varying from 750 to 3000 rpm and gas calorific values of 133 to 124.5 Btu per cu ft. The fire length was 12½ inches, its temperature was about 3000 F and the diameter of the tuyere was one inch. The air consumption was approximately 5.5 lb and 83 to 87 cu ft of gas were produced, respectively, per lb carbon burned. The gas temperatures at the mixing valve varied from 80 to 180 F. No water was supplied and the hydrogen in the gas varied from 5.2 to 2.9 per cent, but the carbon monoxide remained constant at 32 to 33 per cent. A similar series of tests was made on the British emergency producer, and some of the comparable results obtained are given in Fig. 5.

This shows that the capacity of both producers is about the same at equal air velocities, notwithstanding the fact that the B E tests were made with a blower, and the A E tests with a Ford V-8 engine. The pressure drop across the A E unit is much greater than that across the B E unit, probably because of the greater frictional resistance of the final filter. The temperature of the gas leaving the A E producer varied from 565 to 1000 F, but as these were not final values, they have not been plotted on Fig. 5. The tem-

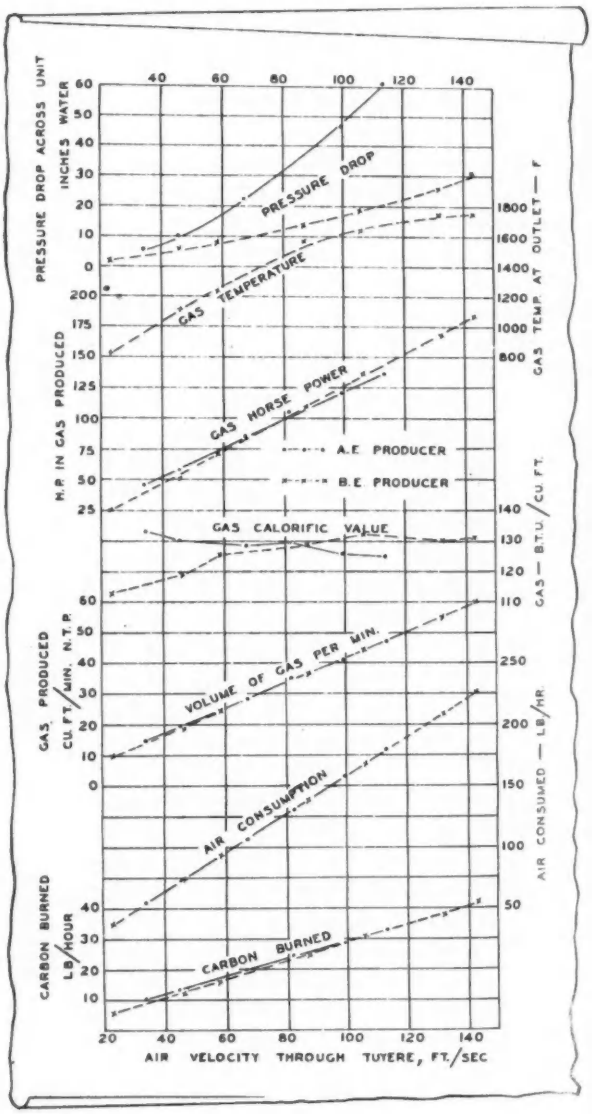


Fig. 5—Comparative test results on the Australian and British emergency cross-draft producers.

Part Two

Part One appeared in the August 1, 1943, issue of AUTOMOTIVE and AVIATION INDUSTRIES.

Motor Transport

peratures obtained in the B E producer seem to be abnormally high, and it is difficult to understand how burning of the metal is avoided under these conditions.

Power and Economy

Characteristic power and economy curves for a gasoline engine are shown in Fig. 6. The best economy at full throttle is obtained with a mixture containing from 10 to 15 per cent of excess air, but, as the throttle is closed progressively, somewhat richer mixtures must be supplied. On the other hand, the best power is always obtained with a rich mixture containing about 20 per cent of excess fuel that cannot be burned. This illustrates the fundamental fallacy of many devices that purport to give both improved power and economy. The conditions that produce greater economy in a gasoline engine almost invariably give less power. Tests made on a single cylinder variable compression engine, using producer gas, showed that:—

(a) The power-mixture strength curve rose to a sharp peak with a mixture containing about two per cent of excess air (Fig. 6). With 30 per cent of carbon monoxide in the gas, this corresponds to slightly less than 50 per cent of gas in the mixture (as compared with about two per cent for gasoline). Good mixture control is therefore essential.

(b) Compression ratios up to 15:1 may be used without trouble.

(c) At a compression ratio of nearly 8:1 and a speed of 1500 rpm, the combustion period occupied about 40 deg of crank angle. This indicates the necessity for increased spark advance as compared with gasoline. Alternatively, multiple spark plugs may be used.

(d) The indicated thermal efficiencies at all compression ratios between 6 and 16 were about 60 per cent of the "air standard" efficiencies. The actual maximum thermal efficiency was about the same as that obtained with gasoline (Fig. 6) and occurred with a mixture about 30 to 40 per cent "weak."

(e) The net calorific value of the correct producer gas-air mixture is about 70 per cent of that corresponding to the correct gasoline-air mixture. The volumetric efficiency of the engine is also less when gas is used because of the relatively high gas temperature, the absence of the cooling effect derived from the evaporation of liquid fuel and the greater frictional loss of the piping and cleaning apparatus. The mechanical friction in the engine itself is not affected materially by the change from liquid to gaseous fuel and therefore,

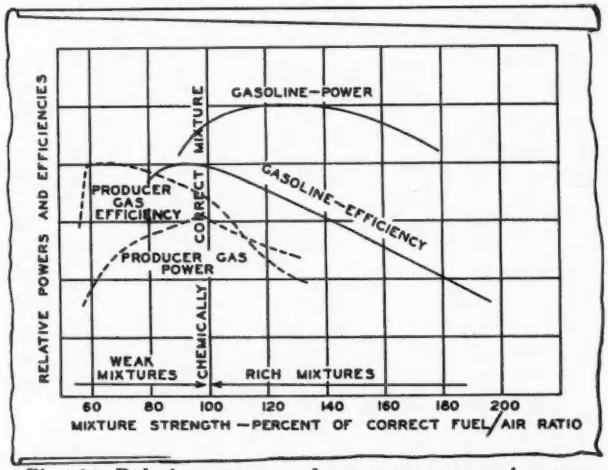


Fig. 6—Relative power and economy curves for producer gas and gasoline with varying mixture strengths. No vertical scale has been given, as the figures are entirely comparative. They are intended to show that the maximum power obtained with producer gas is about 60 per cent of that obtained with gasoline, and that the maximum efficiency is about the same in both cases.

with the weaker combustible mixture, the mechanical efficiency of the engine falls. For these reasons, the horse power obtainable at low speeds from an engine of a given size, when using producer gas, is only 60 to 65 per cent of that obtained on gasoline. The comparison may be still more unfavorable at high engine speeds, as the resistance of the cooling and cleaning apparatus increases rapidly with the speed and may be as high as 30 to 60 inches of water gage (Fig. 5), particularly if the filters are dirty. It is not safe, therefore, to anticipate a maximum power of much more than half that obtainable from liquid fuels. The Australian tests gave a power ratio of 51.5 per cent, and the British report states that a vehicle is "one gear worse" on producer gas than on gasoline. Power ratios of 70 to 75 per cent have been claimed in some instances.

This analysis indicates one of the principal objections to the substitution of producer gas for gasoline in trucks, tractors or marine work where the load factor is high. Most cars work, for the greater part of the time, at less than half of their load capacity, the full power of the engine only being required occasionally, but trucks have to carry heavy loads for long periods and must adhere to definite time schedules. Possible remedies for this difficulty are:—

(1) The use of larger engines. This is only possible with new vehicles.

(2) Reduced loads, longer time schedules, or both. These imply a reduction of transport and earning capacities.

(3) Higher compression ratios (say 8 or 10 to 1). The consequent increase of thermal efficiency will raise the power ratio possibly up to about 70 per cent, but this method introduces difficulties when gasoline is used for starting or emergency operation, though alcohol may perhaps be substituted for these purposes. Moreover, it is frequently difficult to change materially the compression ratio of existing engines.

(4) Supercharging. This requires a power drive for the supercharger unless exhaust driver superchargers are used. The latter add to the cost, complication and weight of the plant and are of doubtful practicability. Nevertheless, a supercharger of this type has been used by the Brown Boveri Company to put the whole of a wood gas producer plant under pressure. The top of the producer is held down by springs and so acts as a safety valve which blows off at an internal pressure of 7 psi. It is claimed that the test results on this plant indicate that the torque obtained on a Saurer truck at different speeds is equal to that of the same truck driven by a compression ignition (Diesel) engine. The weight of the turbocharger for 40-150 bhp engines is 77 lb. Leaky joints or connections would form a considerable hazard in this kind of plant.

(5) Mixture of producer gas and gasoline. Tests made on a single cylinder stationary engine with a compression ratio of about 5.8 to 1 and a speed of 1500 rpm, gave the following comparative results:

Gasoline, per cent in mixture	100	72.1	41.7	22.6	0
Maximum Indicated Mean Effective Pressure, lb per sq in...	137	120	107.5	97.4	93.0
Maximum Brake Mean Effective Pressure, lb per sq in .....,.	117.7	100.5	87.4	76.5	73.5
Power Ratio expressed as a percentage of that obtained with gasoline	100	85.5	74.3	65.0	62.5

It is impossible to make any categorical statement regarding relative running costs, as so much depends on size, fuel taxation, running conditions, etc., but fuel consumptions of heavy vehicles vary usually from 0.9 to 1.3 lb of charcoal per hp-hr. A four-cylinder 12 hp car weighing 2550 lb ran for 5000 miles with an average fuel consumption ("activated progasite") of ½ lb per mile, and a continuous run of 100 miles was made on this fuel with a consumption of 0.4 lb per mile. The British report gives the average consumption of anthracite for a vehicle of six tons gross weight as 1.5 to 2 lb per mile.

Tests made in Australia on the British emergency producer mounted on a trailer (weighing 1150 lb) towed by a Ford V-8 utility truck and carrying a load of 550 lb, gave a charcoal consumption of 1.03 lb per mile. Woods quotes heat consumption figures for trucks ranging from 4300 to 8900 Btu per load-ton-mile for pay loads varying from 6.9 to 1.5 tons, respectively, and a test in Great Britain gave a consumption of 4110 Btu per ton mile for a pay load of 4.6 tons at a speed of 26.3 miles per hour.

Tests made by the French Department of Agriculture indicated that, with an efficient engine, 12 lb of charcoal (or anthracite) or 22 to 24 lb of wood (less than 18 per cent moisture) gave the same mileage as one gallon of gasoline. A comprehensive series of tests was made in Switzerland by Schläpfer. Various estimates gave comparative fuel costs ranging from one-half to less than one-third those of gasoline. Comparisons with fuel oil are not so favorable and vary with local rates of taxation on liquid fuels.

As no excess fuel is required in the mixture to produce full power, and as complete mixing of air and fuel is easy, no trouble is experienced with the effects of incomplete combustion or with carbon monoxide in the exhaust gases. The uniform mixture also ensures the generation of equal amounts of power in the different cylinders of multi-cylinder engines.

Fuels

Producer gas can be made from almost any carbonaceous fuel, but considerations of weight and space occupied by the producer plant and fuel storage play an important part in the final choice. From a gas-making standpoint, the most important property of the fuel is its "reactivity." This is sometimes indicated by its "critical air blast" (C.A.B.) value, which is the minimum rate of air supply that will support the combustion of a graded fuel sample when tested under standard conditions. The lower the C.A.B. value, the greater the reactivity and the more suitable is the fuel for gas-making.

The following typical values are given by Norton:

Charcoal—less than	.01
Low temperature coke	.01
Bituminous coal—about	.02
Anthracite, not less than	.035
Gas coke	.06
Furnace coke	.07

Tests on a cross-draft producer indicated that, for this type of apparatus, the permissible upper limit of the C.A.B. value was .04.

The best results have usually been obtained with wood charcoal, which has the highest reactivity (probably because of its porous structure), and is relatively free from ash and impurities. The provisional specification for Australia describes the principal desirable characteristics and standard methods of testing. The charcoal should be clean, free from "fines," and should not shatter or crumble in service. The size should be between ½ and one inch, and the ash should not exceed four per cent of the air-dry weight of the charcoal. No limit is fixed for the volatile matter, but elsewhere it is recommended that this should be about 10 per cent.

The reactivity is expressed, in some instances, as the volume of carbon monoxide formed by passing 100 cubic centimetres of carbon dioxide over the fuel at a temperature of 1740 F and at a rate of five cc. per

Harold Gibson (left) says "good-bye" for the duration to A. P. Miller, Ass't. Gen. Supt.

Good Hunting, Harold!

Harold Gibson is going hunting—hunting down the tyrants who seek to destory our freedom. He is Inland's 3000th man to join the Armed Forces, and they continue to leave at the rate of 200 per month.

Several years ago, Harold started to work as a laborer in the Inland mills. Unhampered by tradition, or class restrictions—living the Four Freedoms—he advanced to crane operator at the No. 2 Open Hearth yard. That is the American way—under which free men choose time, place and type of work, and win advancement through ambition and ability.

Even with more than 25% employee replacements since the war began, our average steel production has been maintained at more than 100% of capacity. So, we Inland steelmakers, 14,000 strong, say, "Good hunting, Harold," and back him and the others with Bonds, sweat and steel.

ARMY E NAVY

INLAND STEEL COMPANY

CHICAGO

minute. By this valuation the reactivity of charcoal is about 180, and that of coke 40 to 60; this scale appears to be more open than that of the C.A.B. method, and so is a more practical one. Australian charcoal (air dry) has a calorific value of 12,000-13,600 Btu per lb, and Canadian charcoal of 12,500 Btu per lb or higher. Canadian hardwood charcoal contains approximately five per cent moisture, three per cent ash and 17 per cent volatile matter. Uniformity of size is desirable to avoid excessive resistance in the fire and the clogging of cleaning apparatus by dust and small particles. The low density of charcoal (about 14 lb per cu ft) makes it necessary to provide a large hopper so that a journey of 100 to 150 miles may be made without refueling. Charcoal bri-

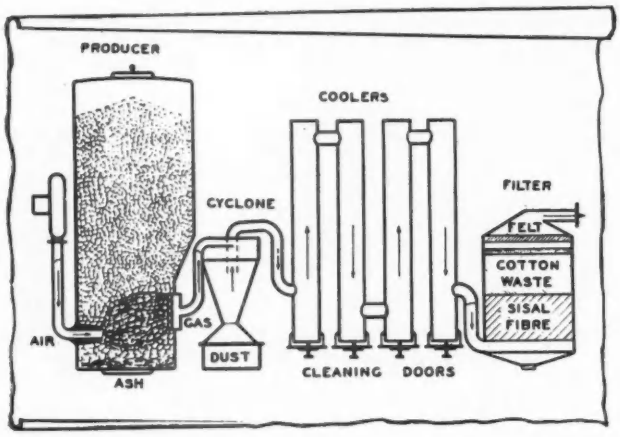


Fig. 7—Diagram of Australian emergency gas producer plant.

quettes, with densities up to three times that of coal, have been used in some producers, but their advantage is doubtful, on account of the reduced reactivity of the fuel which probably necessitates a larger fire, less flexibility and longer time for starting. It may be advantageous for using up the finer grades of charcoal.

Many producers have been operated on wood, generally containing up to 18 or 20 per cent of moisture and supplied in pieces approximately 1½ in by 1½ in by 3 in. Hard wood is preferable, but soft woods may be used with a greater depth of fire to break up the volatile matter distilled from the wood. If these vapors are not decomposed, they must be removed in the scrubbers, otherwise they will cause trouble in the engine. For this reason, larger and more complicated cleaning apparatus is usually required. With wood fuel, a larger fuel hopper and furnace must be provided, and also there is an increased loss of heat in the water vapor which leaves with the gas. Nevertheless, the large amount of hardwood that is immediately available in Canada forms an important, potential supply of fuel for use in an emergency.

Peat and peat charcoal are possible fuels, but the former is difficult to dry and the latter is inclined to be friable. Peat charcoal, produced by a special low temperature distillation process, was tested on a four-ton truck in Scotland and is stated to have given better results than those obtained on a low temperature coke. Comparative tests made on low temperature coke and charcoal showed little difference between the two fuels, as far as performance and idling were concerned. The coke gave better acceleration after idling, in spite of the fact that the temperature of the plant was higher than that obtained with charcoal, but the clinker formation was much greater with coke. The latter fuel is also stated to give more cylinder wear than anthracite does.

Countries which have access to coal but possess little timber, generally use anthracite or coke. Accordingly, the British emergency producer is designed principally for these fuels, and the specification gives the best grading for anthracite as ¼ in. to ⅝ in., though somewhat smaller sizes can be used, if necessary. The quantity of volatile matter should be less than 7 per cent, and the ash less than 4 per cent. The principal advantages of anthracite are, that no preliminary processing of the fuel is required, the fuel does not disintegrate when shaken and its density is high (about 55 lb per cu ft) so that a large weight can be carried in a small container.

The size and weight of the plant for a given horse power is influenced considerably by the kind of fuel used, as this governs the size of the fire, the dimensions of the fuel hopper and the kind and size of cooling and cleaning apparatus employed.

The following figures are reasonably representative of current practice:

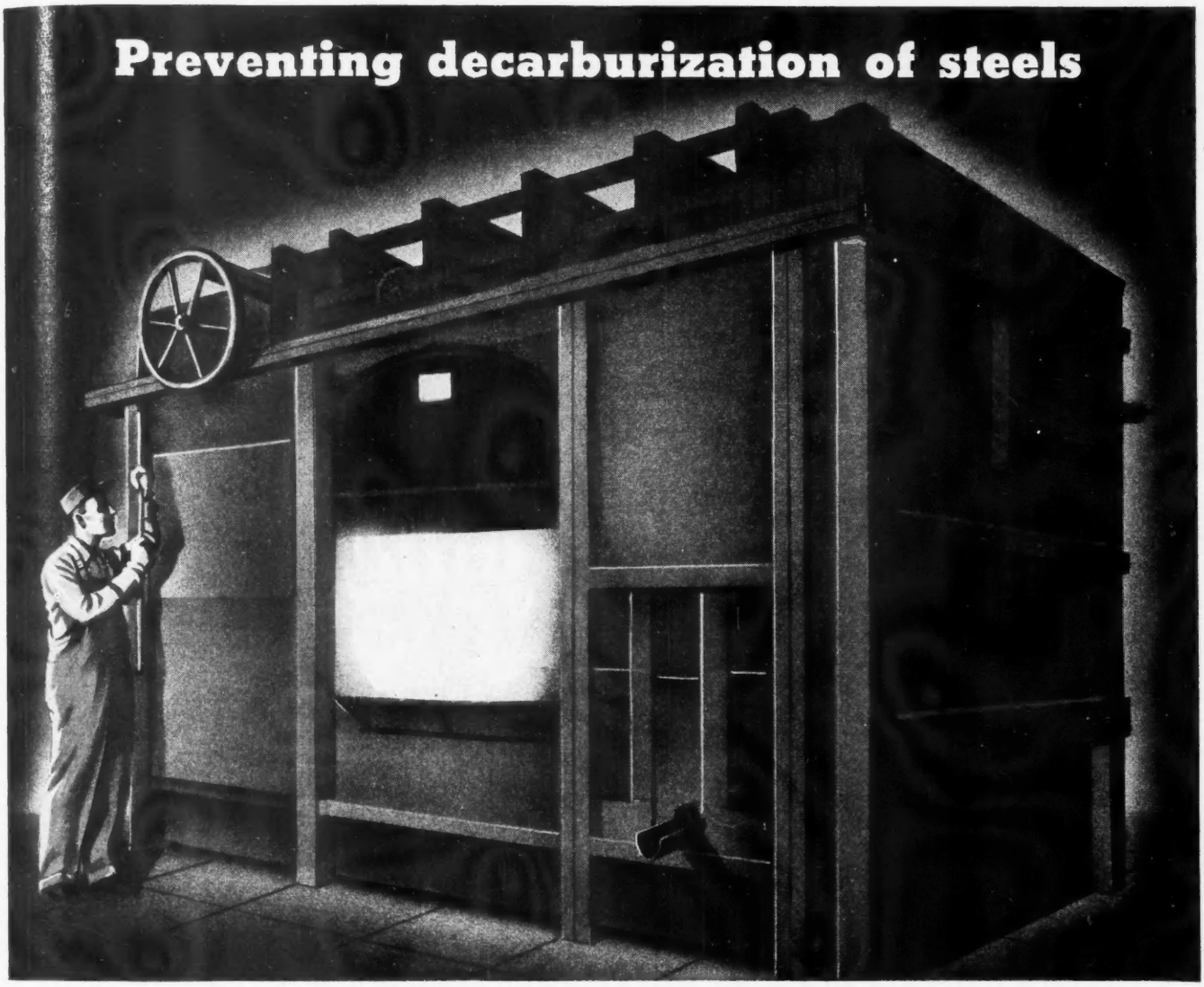
The Brush-Koela producer for a 2½-ton truck is about 14 in. in diam by 4 ft 5 in. high, and weighs 280 to 336 lb, according to the layout employed. The Gohin-Poulenc producers vary from 14 to 20 in. in diam and from 3 ft 6 in. to 6 ft 6 in. high. For a 7-ton truck (empty) the weight is 620 lb or 3.9 per cent of the pay load. A wood burning producer, for the same service, weighed 1200 lb or 7.7 per cent of the pay load. The weight of producer for a 32 passenger bus (53 hp engine) is 560 lb, and the hopper contains 510 lb of coal, sufficient for 200 miles. The British emergency producer, which is mounted on a trailer, is 18 in. diam by 4 ft 6 in. high, and the weight of the whole trailer unit is 1150 lb. The producer and cleaning plant are made entirely of steel pressings and are designed for the rapid conversion of vehicles at a minimum cost.

Cooling and Cleaning the Gas

The temperature at which the gas leaves the producer, which may be as high as 1750 F (Fig. 5), makes it necessary to cool the gas as much as possible before it enters the engine, otherwise the reduction of volumetric efficiency will seriously affect the power obtained. With a gas temperature of 120 F (air temp. 75 F) the reduction of engine power is about 8 per cent if the gas is dry, or 17 per cent if saturated. It is desirable, therefore, to avoid wet scrubbers if the gas can be adequately cooled without using water.

The presence of dust or ash in the gas is also undesirable, as it contaminates the lubricating oil and causes wear in the cylinders. The amount of dust allowable has not been determined definitely, but it is stated that, with less than 20 milligrams per cubic meter of gas (.0002 oz per cu ft) the cylinder wear

Preventing decarburization of steels



Information supplied by an Industrial Publication

The principal factors that must be considered in any attempt to prevent the decarburization of steel are the steel analysis, temperature and time of heat treatment and the furnace atmosphere.

All of them are subject to modification, or control, as a means of prevention. But since changes in steel analysis, or in temperature and time of treatment are often impractical, the furnace atmosphere offers the best general point of attack.

If the furnaces in use are basically unsuitable, the best method of correcting the trouble is to replace them with controlled atmosphere furnaces carefully selected to meet individual requirements. If this cannot be done, an analysis of the furnace atmospheres should be made to determine whether or not carbon dioxide or water vapor are present. If they are, one remedy consists of installing auxiliary equipment to eliminate the CO_2, and to reduce the H_2O to the lowest possible level.

There is another method that may work if light scale on treated parts is not objectionable. This consists in using a slightly oxidizing atmosphere (2-5%). Decarburization of certain high carbon and tool steels is virtually eliminated. The method is safe to try with steels that do not require temperatures over 1600° F.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

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is no more than that obtained with gasoline. The following figures were quoted by Burstal from results obtained by Reisch on charcoal producer gas cleaned in three different ways. Full details were not given, but the results indicate the order of magnitude of wear and the variation due to the various cleaning devices:

Group A—.205—.253
B—.327—.343
C—.46 —.647
} thousandths of an in. cylinder wear per 1000 miles travelled.

For comparable figures on gasoline see "Cylinder Wear in Gasoline Engines," Williams, SAE Trans., May, 1936, pp. 191-196; and "Observations on Cylinder Bore Wear," Roeusch, SAE Trans. March, 1937, pp. 89-98. The average rate of wear with gasoline is generally in agreement with the figures in Group B.

The velocity of air and gas through the fuel bed, which is controlled by the speed and load of the engine, has a great influence on the amount and grade of dust that must be handled by the scrubbers. Beresinsky obtained the following results on an Australian cross-draft producer with a fire 12 in. long between tuyere and outlet grid:

Rate of Gasification cu ft/min	Speed Miles per hour	Dust Mg per cu meter	Dust in Gas lb/1000 miles
35	35	650	2.5
50	50	5960	22.4

The relatively low gas velocity through the up and down-draft producers (40 to 80 lb fuel gasified per sq ft grate per hour) probably causes less dust to be carried over than in the case of the cross-draft type.

A method of testing the efficiency of cleaners and scrubbers has been devised by Beresinsky, consisting of an aspirator drawing heated gas through a standard filter. This gives consistent results and has revealed the fact that, generally, the most efficient cleaners give the greatest resistances to the passage of gas. In the tests on the "A E" producer, the quantity of dust entering the gas mixing valve was less than one milligram per cubic meter when tested on the road at 30 mph, but usually the pressure drops obtained during the road tests were greater than those in the bench tests (Fig. 5), probably because the vibration consolidated the fuel in the producer and the fiber in the filter. The cyclone separator used in the A E producer is efficient for removing large particles, but a filter consisting of layers of sisal fiber, cotton waste and felt, is also used to remove fine particles (Fig. 7). Between the two, are four vertical cooling cylinders with cleaning doors, which also act as a gas storage to meet sudden demands from the engine. European practice appears to favor cloth filter bags, but in some instances wet scrubbers are used, particularly with wood fuel. In the latter case, however, it is stated that neither dry nor wet scrubbers can remove every trace of tar and acetic acid from the gas. Oiled coke, or oily baffling surfaces, are sometimes employed, but are not so efficient as fabric or fiber filters for fine dust separation. The British emergency producer has four horizontal coolers (each 6 in. diam and 3 ft 6 in. long) arranged in series, and two filters in parallel, each containing four beds of sisal tow. Regular cleaning is necessary to avoid clogging and excessive resistance, particularly as, if the pressure drop across the sisal filter becomes great, channels may form in the filter bed, reducing its efficiency as a cleaner. In some instances, a flame trap is placed between the mixing valve and the scrubbers. The gas mixing valve and carburetor are connected to a Tee bolted to the intake manifold.

Operation and Installation

The running of a gas producer plant does not offer any great difficulty to the average driver. If water feed is used with hand operation, the rate of water supply controls the temperature of the producer and the quality of the gas, but in most instances this quantity is adjusted automatically to suit the rate of gasification.

Starting from cold is usually performed by running the engine for a short time on gasoline and using the suction to draw a flame into the fuel bed from a torch inserted through the tuyere or other convenient opening. Various starting times, ranging from 1 to 10 min, are quoted by different authorities, a good deal depending on the type of producer, kind of fuel and local conditions, but in most instances the fire must be nursed for some time, as full power cannot be obtained until there is a substantial volume of incandescent fuel available for gas making. This period lasts for approximately 20 to 30 min after starting. With high compression engines, it may be necessary to use a fan, operated either by hand or electric motor for the purpose of blowing up the fire. In that event, care must be taken to ensure the escape of gas into the open air, and not into a garage, as the 30 per cent of carbon monoxide in the gas is very poisonous.

At the end of the run, or day, the producer is allowed to cool down, after which the ash, clinker, etc., may be removed. Some producers have shaking grates and automatic ash discharges, but these are unusual nowadays, particularly with charcoal fuel. Stops of from one to two hours are possible, but in most instances it is necessary to idle the engine so that the fire may be kept alight. It may also be necessary, on restarting, to run for a short time on gasoline, to reestablish the volume of fire that is required for full load operation.

The necessity of systematically cleaning scrubbers and filters has already been noted.

It is evident from the above, that the gas producer is most suitable for large and heavy vehicles that have been designed specifically for this kind of fuel, although some small plants have been placed in car trunks and on running boards. Buses have the producer enclosed in a special compartment at the back or front, and trucks have them mounted on the side of the chassis. Existing chassis, however, usually have insufficient room for the producers and cleaning plant, so that both the British and Australian emergency producer plants are mounted on two-wheeled trailers that are towed behind the trucks. This increases the wind resistance of the vehicles but gives effective cooling.

(*Turn to page* 60, *please*)

No Thread Seizure!

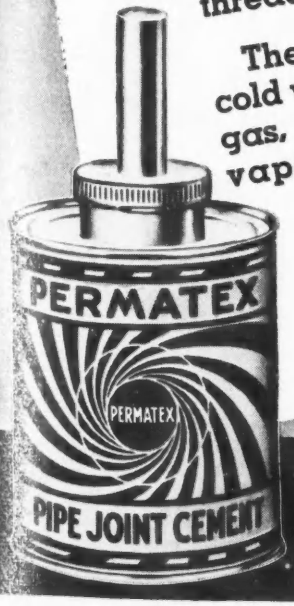
LONG STANDING, LEAK-PROOF UNIONS DISASSEMBLE READILY!

The lubricating, non-hardening properties of Permatex Pipe Joint Cement permit easy readjustment of pipe lines . . . without thread seizure.

Permatex Pipe Joint Cement is a heavy, brushable, ready-to-use product. It flows easily from the brush, spreads evenly over the threads and "stays put".

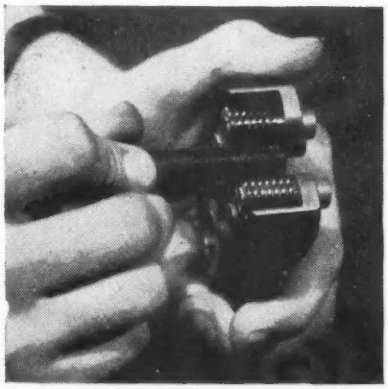
The applied film is leak-proof to hot and cold water, steam, salt water, illuminating gas, lubricating oils, gasoline, gasoline vapor, kerosene, ethylene glycol and numerous other liquids and gases.

Permatex Pipe Joint Cement is used wherever pressure-tight, leak-proof unions are required.



PERMATEX COMPANY, INC.
Sheepshead Bay, N. Y., U. S. A.

New Production Equipment



Sheffield Thread Roll Snap Gage

THE Sheffield Thread Roll Snap-Gage, a combined "Go" and "No Go" limit gage for rapidly checking male threads to both maximum and minimum limits in one operation, is a new addition to the line of gages made by the Sheffield Corporation, Dayton, Ohio. The gage consists of a frame, similar to a plain snap gage, in which two sets of gaging rolls are mounted, each roll being free to rotate. One set of rolls represents the "Go" limit, and the other the "No Go" limit.

Thread roll snap gages not only check the assembly of male threads with female threads, but also assure uniform interchangeability within prescribed limits of the work passed. In addition, they are said to reveal specific inaccuracies so that steps can be taken to correct the tool or machine at fault.

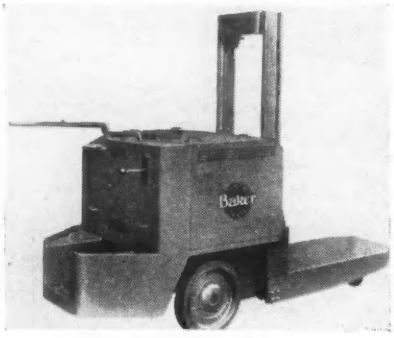
Sheffield Thread Roll Snap Gages are furnished standard for American National form, coarse and fine series. Gages for all other forms are considered special and made to order.

THE Baker-Raulang Company, Cleveland, Ohio, offers a new 4000 lb. capacity Hy-Lift truck, known as the Type H-2, which is a companion truck to the Type E-2 announced recently and can be used interchangeably in the same material handling system with it. This new Hy-Lift truck combines the self loading feature with tiering, and is useful for both transporting and tiering skidded material.

The truck is built on a 66 in. wheelbase; its overall length is 123¾ in. and it is designed for operation in intersecting aisles 67 in. wide. An overall height of 83 in. permits entrance into box cars, for loading, and provides a maximum lift of 67 in. The platform, which is 26½ in. wide by 54 in. long, is 11 in. high when in the low position.

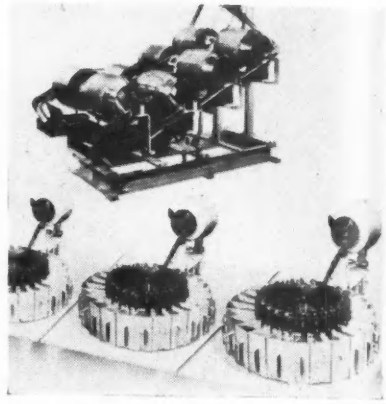
The battery box has been increased in size from 27 in. by 36⅝ in. to 32 in. by 39½ in., providing space for additional battery capacity so that the truck may be operated continuously on long shifts. It is not necessary, under most conditions, to stop during a working shift to change batteries.

An improved hydraulic lift system provides positive control of hoisting and lowering. The control lever starts the pump motor and closes the valve, forcing oil into the jack cylinder. Lowering is by gravity, controlled by the same lever. All controls, together with the lift motor and pump, are in a control panel and are readily accessible.



Type H-2 Hy-Lift Truck

A NEW rivet sorter, known as No. 101-Model B, is now in production at Southern Engineering Company, Inc., Los Angeles, Cal. The unit selects in increments of 1/32 in. in lengths of 3/32 in. to ½ in., and in increments of 1/16 in. from ½ in. to 1½ in. in length. A separate section sorts rivets by head sizes. The No. 101-Model B Unit consists of two sections, the screening section and the disc sorter section. It handles countersunk, brazier, flat, and round head rivets.

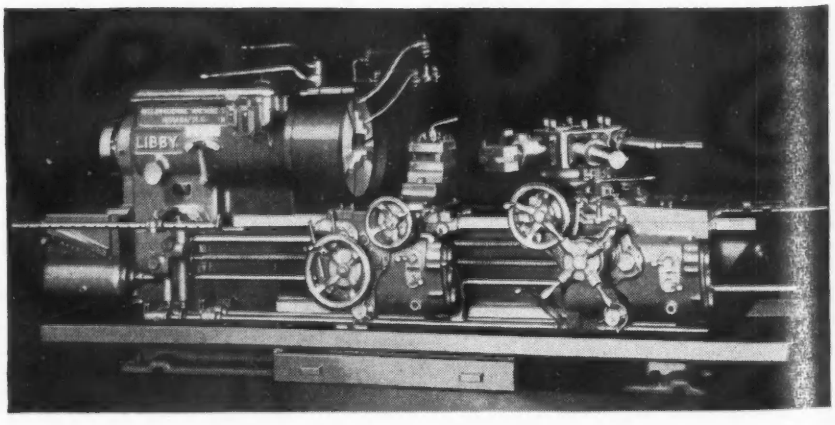


No. 101—Model B Rivet Sorter

THE new line of Libby Type H heavy duty turret lathes, incorporating special features and standardizing on sizes for both the regular line of heavy duty turret lathes and the fixed bed and sliding bed type machines, was recently announced by the International Machine Tool Corporation, Libby Division, Indianapolis, Ind.

The five standard sizes of Libby Type H heavy duty turret lathes are built with different size spindle bores to accommodate various classes of work. Included in the new line are five stand-

(*Turn to page 92, please*)



Libby Type H Heavy Duty Turret Lathe

FREE TO WAR INDUSTRIES

To Help Increase Wartime Production, Cities Service Offers All Essential Industries A Free Industrial Heat Prover Test!

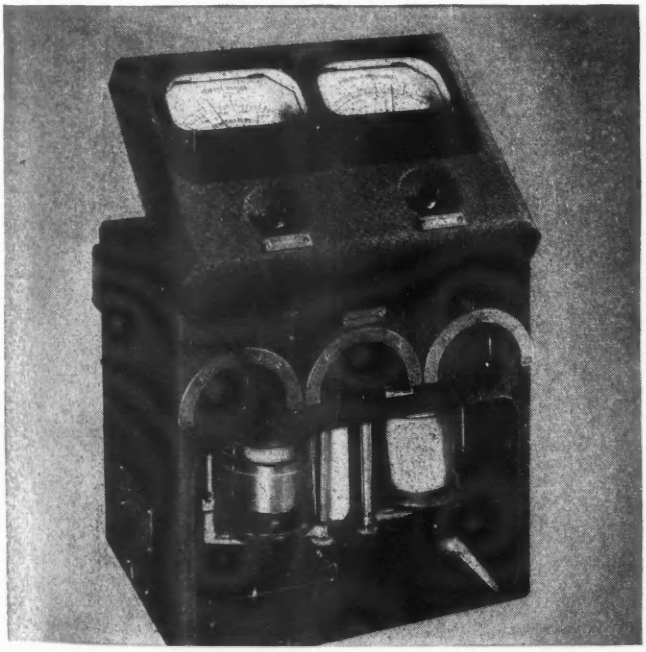
This test helps to solve combustion problems, reveals how fuel can be conserved, and the quantity and quality of the product increased.

Today, a vast majority of our industrial plants still are without any means of maintaining *accurate* combustion control.

It is to these plants that Cities Service Oil Companies now offer, *without charge or obligation*, a complete combustion control test with the unique, new Cities Service Industrial Heat Prover. This service is available on request in most of the important industrial cities East of the Rocky Mountains.

The Cities Service Industrial Heat Prover has been thoroughly tested on practically every type of combustion equipment in this country and with every kind of fuel.

It has been adopted by users of steam power plants, open hearth furnaces, cement kilns, heat-treating apparatus, crucible furnaces and internal combustion engines.



THE CITIES SERVICE INDUSTRIAL HEAT PROVER—a new, accurate combustion analysis instrument—developed by the Cities Service Research Division to enable those engaged in the oxygen control of furnace atmospheres to achieve greater combustion efficiency at less cost.

Accurate combustion analysis made as a result of the Cities Service Industrial Heat Prover tests have resulted in considerable savings in fuel costs, have reduced repairs and replacements on furnace linings, crucibles and refractories due to flame corrosion . . . and have led to increased production of better and more uniform products.

Wire or phone your nearest Cities Service office or mail the coupon today—for a Cities Service Industrial Heat Prover test in your plant.

A member of the Cities Service engineering staff will then visit your plant at your convenience and make a Heat Prover analysis of your combustion processes. This engineer has been carefully trained for the purpose, and has at his command extensive information gathered by the Cities Service Research Division from power, metallurgical and chemical fields.

CITIES SERVICE OIL COMPANY
Room 1668
Sixty Wall Tower, New York 5, N. Y.

Please arrange a Cities Service Industrial Heat Prover test for my plant. I understand there is no charge or obligation for this service.

Name_____

Title_____

Company_____

Address_____

OIL IS AMMUNITION—USE IT WISELY!

CITIES SERVICE OILS — ONCE-ALWAYS

CITIES SERVICE OIL COMPANY
NEW YORK · CHICAGO

IN THE SOUTH
ARKANSAS FUEL OIL COMPANY
SHREVEPORT, LA.

73,132 Planes Delivered to Army Between Pearl Harbor and July 1

Production of the Automotive Industry Continues to Show Gains Despite Cancellations and Schedule Cutbacks

Packard Motor Car Co. has taken over the unfinished $5,000,000 Laskey Road plant of the Aviation Corp. at Toledo and will operate it as Packard's Toledo Division for the manufacture of parts for Rolls-Royce aircraft engines. The DPC plant, which contains several hundred thousand square feet of floor area, was occupied by the Liquid Cooled Engine Division of Aviation Corp. until May 15, when further work was halted by order of WPB. It was scheduled to produce a liquid-cooled aircraft engine for the U. S. Navy, which heretofore has relied exclusively upon air-cooled radial engines in its aircraft. Only 450 production employes were on the payroll when the plant closed.

Much of the machinery in the Toledo plant will be taken over by Packard to make Rolls-Royce parts. This conversion will not be difficult because the plant was being tooled up to produce a liquid-cooled engine and the Rolls-Royce also is liquid cooled. Several hundred parts now machined by Packard at Detroit eventually will be processed in the Toledo plant in line with expanding output by Packard. This is part of Packard's program for doubling Rolls-Royce aircraft engine production in 1943 over the 1942 rate. Two thousand major parts for the engine are made by Packard, while 400 subcontractors furnish another 10,000 smaller parts. The Rolls-Royce engine is much in demand because it goes into the Curtiss P-40-F and the North American P-51 as well as being installed in such British planes as the Spitfire, Lancaster and Mosquito. The Toledo Division is Packard's first manufacturing operation outside Detroit since the company moved from Warren, Ohio, in 1903.

Murray Corp. of America also has gone outside the Detroit area in expanding production of bomber airframe sections. The company's new plant at Scranton, Pa., will measure approximately 1400 x 350 ft., containing nearly 500,000 sq. ft. of floor area. Scranton was selected as the plant site because it is a labor surplus area.

The Ordnance Dept., which previously has relied principally on the Continental-built right Cyclone engine as power plant for the medium tank, recently waxed enthusiastic over the Ford V-8 500-hp. liquid-cooled tank engine. In its first official statement on this engine, the Army said, "During recent Army tests at Fort Knox, Ky., the engine led in endurance tests and topped other engines in nearly all other phases of performance." The Ford tank engine, first ordered in January, 1942, has been in production since April, 1942, at the Lincoln plant in Detroit. Two other engines manufactured for the medium tank and tank destroyers of similar tonnage, the General Motors twin Diesel and the Chrysler multibank, have been shipped principally under Lend-Lease in tanks destined for Great Britain and Russia or for training purposes in the U. S.

That other tank engines are under consideration is indicated by the fact that Chrysler Corp. has 3000 employes doing developmental work on a new tank engine and a new aircraft engine in its Engineering Division. Chrysler last month produced its 10,000th medium tank at the Detroit Tank Arsenal since

(*Turn to page* 88, *please*)

GM Department of UAW-CIO Asks 10 to 11 Per Cent Wage Increase

Walter Reuther Says the "Little Steel" Formula Is No Longer Sound. Asks Price Roll Back or Pay Raise

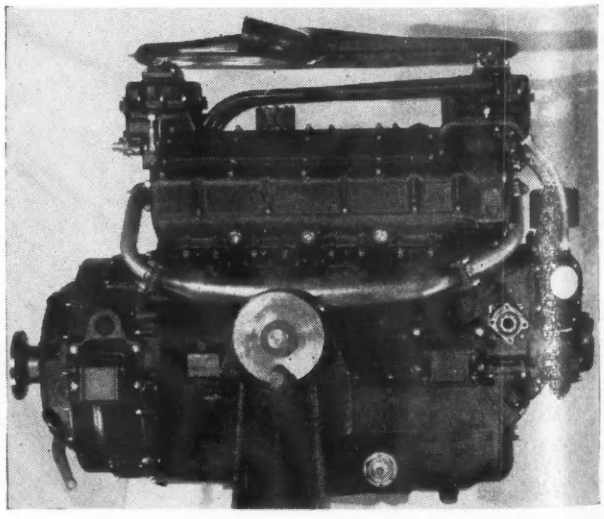
Hearing by a 3-man panel of the National War Labor Board of the contract renewal dispute between General Motors Corp. and the UAW-CIO resulted in the referring of the vacation pay issue to the national board in Washington for decision and the throwing out of other union demands because they did not directly deal with wage adjustments. Ralph T. Seward, New York attorney who was chairman and public member of the 3-man panel in the one-day hearing at Detroit, ruled that union pleas for a weekly wage guarantee, industry-wide stabilization of wage rates and setting up of a post-war employe security fund by the corporation are not part of the present contract and could not come before the panel, which was authorized to deal only with wage adjustments. The GM contract specifies that wage adjustments can be opened six months from the effective date of the contract, or April 5, but the balance of the contract is not open to change until Oct. 5.

Walter Reuther, vice-president and head of the GM Department of the

(*Turn to page* 74, *please*)

Ford Tank Engine

This is the 500 hp liquid-cooled unit which topped other engines in nearly all phases of performance during recent Army tests at Fort Knox, Ky.



FIRE-POWER WINS!

...when horse-power helps!

When you have the most fire-power you win—if you can move in fast enough. That takes horse-power. Engines by the hundreds of thousands in airplanes, tanks, trucks, jeeps, bulldozers, boats and ships depend on Sealed Power piston rings, pistons and cylinder sleeves for their full, eager horse-power.

SEALED POWER PISTON RINGS

SCRAP METAL IS NEEDED FOR EVERY GUN, TANK AND SHIP. SEND *YOUR* SCRAP TO WAR.

SEALED POWER CORPORATION

Muskegon, Michigan • Windsor, Ontario

PISTON RINGS—PISTONS—CYLINDER SLEEVES

Use of Corrosion-Resisting Steels Sharply Restricted

Shortage of Columbium and Molybdenum Limiting Production of Grade MCR Sheet and Strip Steel

By W. C. Hirsch

Much as steel and non-ferrous metal producers would like to be able to translate what is going on in the various war theaters into worth while conclusions regarding the effect on their own industries, they recognize that this is impossible, but they are becoming aware of a marked shortening of the time between battle front developments and the adjustments in equipment and supplies called for. The war has entered upon a phase, in which flexibility of production at home has become as vital as mobility of the troops in the field. One day the fortunes of war may call for putting every bit of emphasis on greater production of steel plate and the next will necessitate a modification of plans so that there may be no curtailment in the output of sheets for the Army's motorized equipment, leaving the problem of how much continuous rolling capacity can be safely diverted from sheet to plate production very much up in the air. Around 200,000 tons of 20- and 22-gage cold-rolled sheets alone will be needed this year to turn out 5-gallon "blitz" cans for Army motor vehicles and similar size containers used by the Air Corps.

The accelerated pace of the war is also reflected in the speeding up of conservation measures, where the necessity of such steps is indicated. The Operating Committee on Aircraft Materials Conservation announced recently approval of a directive to restrict the use of corrosion-resisting steels to certain applications in airframes and airplane engines. This regulation has been approved by joint action of the Army Air Forces, Navy Bureau of Aeronautics, and Aircraft Resources Control Office, Aircraft Production Board. The committee listed two of several limiting factors as being the most critical. They are the shortage of Columbium together with the impracticability of complete conversion to titanium and the shortage of molybdenum, a necessary constituent of material conforming to Army and Navy specifications for corrosion-resisting sheet and strip (Grade MCR) and corrosion-resisting wire. Corrosion-resisting steels may hereafter only be used in parts of the exhaust system that come into contact with exhaust gases and are exposed to high temperatures; supercharger systems; vital engine accessory parts exposed to higher than 800 deg. F. temperatures in fabrication or service; hinges and hinge pins; and welding rods and electrodes used in welding any of the foregoing. The progressive contraction in the available supply of molybdenum, a domestic product, it may be noted, resulted from heavy demand for uses in which formerly imported metals had served.

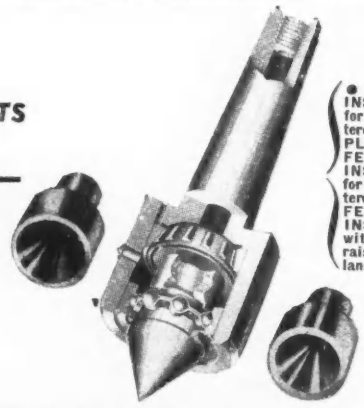
It is now reported that as high as 27 cents a pound has been allowed certain of the small marginal copper producers of Arizona. The ceiling price for copper is nominally 12 cents a pound. Lead is reported to be so light in supply that owners of small mines and potential producers are being urged to apply for development loans or production premiums.

Briggs Wins Award

Briggs Mfg. Co. Aircraft Turret School at Detroit recently won its third consecutive award for having the highest efficiency rating in the Second District of the Army Air Forces Technical Training Command. Its winning rating was 97.85.

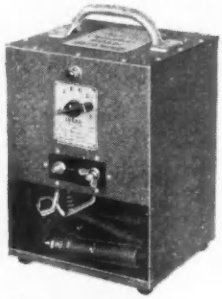
1. CUT FRICTION
2. CUT JOB DELAYS
3. CUT HIGH COSTS

You Get These—
TRIPLE BENEFITS
with IDEAL
"TRIPLE-DUTY"
LIVE CENTERS



Take Heavier Loads and Deeper Cuts at HIGHER SPEEDS

Only with IDEAL Live Centers can you have the many advantages of these three interchangeable inserts. They help you turn out MORE work, in LESS time, on lathes, millers, grinders, etc. Turn heavier loads, take deeper cuts at higher speeds because IDEAL Live Centers rotate *with* the work. Use this precision-built Live Center which is accepted as standard in leading tool rooms and machine shops.

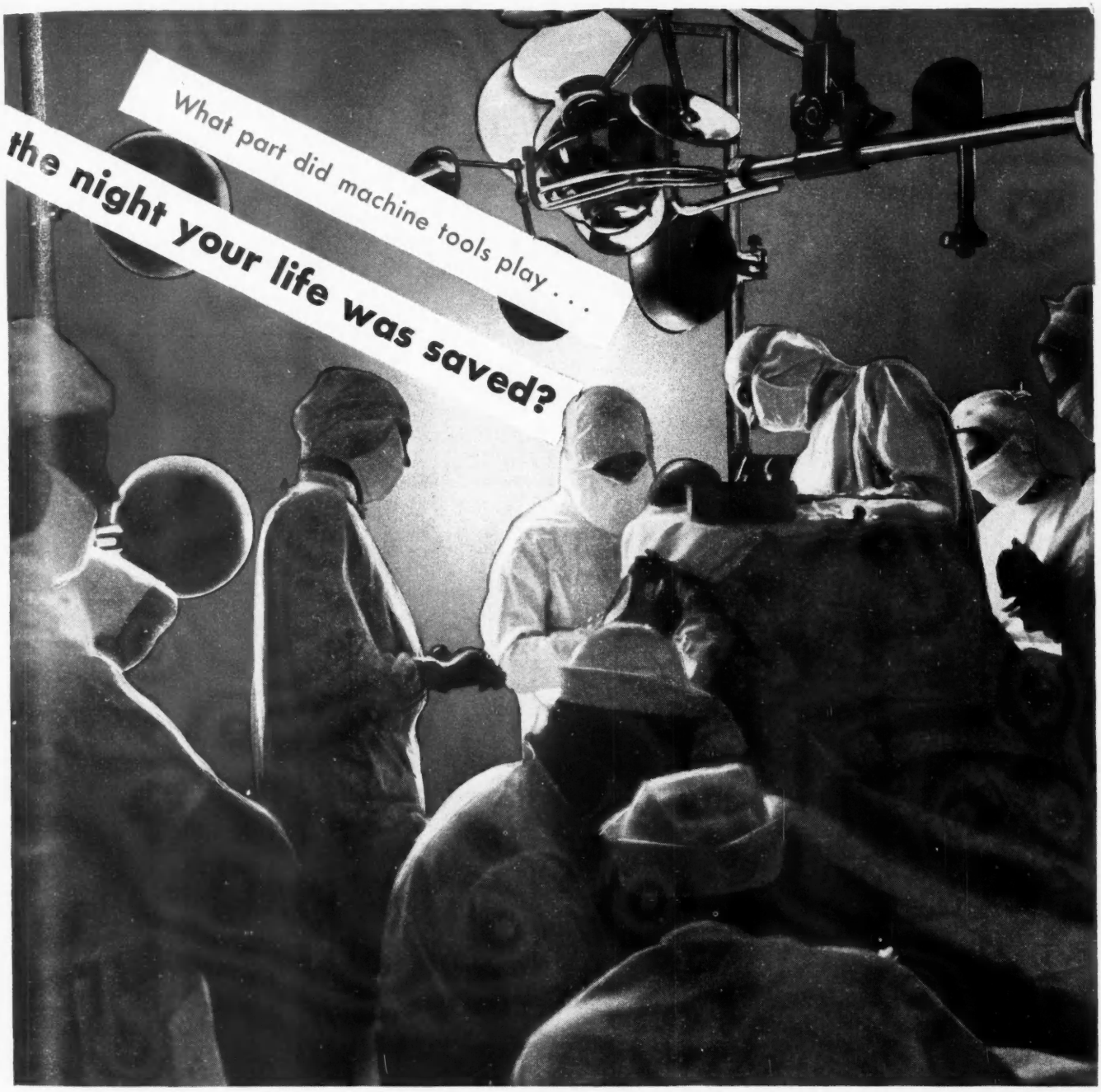


IDEAL *Metal Etcher* This new IDEAL All-Purpose Etcher permanently marks smooth-surfaced iron, steel and their alloys—tools, parts, dies. 14 Heats. Etches legibly, easily, permanently, regardless of the hardness of the metal. Convenient ground clamp for etching large heavy parts and castings.

IDEAL *Demagnetizer* Quickly demagnetizes work held in magnetic chucks, tools, drills, punches, dies, etc. A single pass across the magnetic poles and clinging metal dust, flakes, fine chips, etc., are gone. For small tools and large parts. Demagnetized tools cut faster, stay sharp longer.

FREE . . . Machine Tool Accessory Catalogue gives information on these and many other time-saving tools.

IDEAL *Sycamore*
★ IDEAL COMMUTATOR DRESSER CO ★
3000 Park Ave. Sycamore, Ill.
SALES OFFICES IN ALL PRINCIPAL CITIES.



Remember it? The dim vision of masks and gowns, of lights and gleaming things? They were phantom glimpses in a troubled dream, the night your life was saved — fragments of a shining world of science and strange skills . . .

And every appliance, every gleaming instrument — every sterile garment, swab and bandage — every accessory and apparatus there in the room, that night — was the product of machine tools, or was processed on equipment built by machine tools.

From giant hydraulic presses to the finest internal grinding machines, literally hundreds of machine tools played a part, the night your life was saved.

And of all those unseen instruments that helped to save your life that night, none is more basic to the creation of *everything* that affects your life today than the internal grinding machine.

Bryant Chucking Grinder Company

Springfield, Vermont, U. S. A.

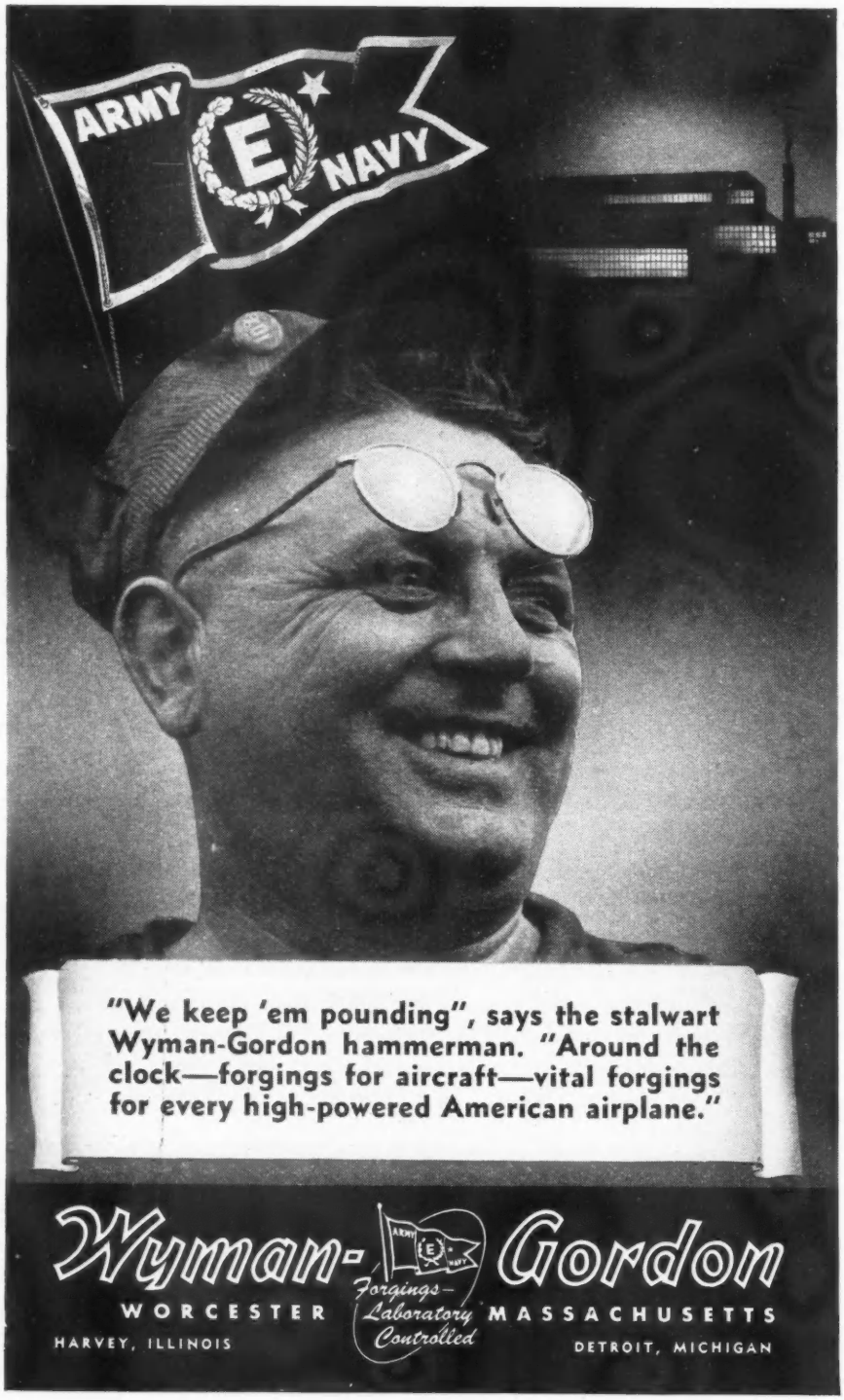
New WPB Advisory Committee Members

Members appointed to the Automotive Maintenance Equipment Industry Advisory Committee of WPB, presided over by J. J. Donovan, are Victor Allen, Automotive Maintenance Machinery Co., N. Chicago, Ill.; C. R. Crowder, Van Norman Machine Tool Co.; Victor B. Day, Bear Mfg. Co.; W. A. Douglass, Sunnen Products Co.; Leo Edelmann, E. Edelmann & Co., Chicago; Charles F. Hodgson, Weaver Mfg. Co., Springfield, Ill.; L. B. Miller, L. B. Miller Co., Brooklyn, N. Y.; B. M. Muchmore, A. Schrader's Son; John A. Murname, Noera Mfg. Co., Waterbury, Conn.; Ira Saks, Accurate Parts Mfg. Co., Cleveland; Frank J. Schwab, Lempco Products, Inc., Bedford, Ohio; Newell P. Weed, Heyer Products Co., Inc., Belleville, N. J.; K. R. Wilson, K. R. Wilson Co., Buffalo; L. F. Woolman, Allen Electric & Mfg. Co., Kalamazoo, Mich., and L. F. Working, Clayton Mfg. Co., Alhambra, Cal.

Among the members of the Aluminum Foundry Industry Advisory Committee of WPB are A. J. Langhammer, president of the Amplex Division of Chrysler Corp.; B. H. Newell, assistant mfg. manager of the Buick Motor Division of GM, and H. G. Lamker, superintendent of foundries of Wright Aeronautical Corp.

Membership of the Industrial Liquid-Cooled Gasoline Engines Industry Advisory Committee of WPB, presided over by R. L. Vaniman, comprises Charles Ballough, Hercules Motors Corp.; L. H. Crafts, Sterling Engine Co.; A. W. Lavers, Minneapolis-Moline Power Implement Co.; Ralph K. Mangan, The Buda Co.; J. E. DeLong, Waukesha Motor Co.; Earl Ginn, Continental Motors Corp.; J. A. O'Malley, Chrysler Corp.; C. W. Pendock, Le Roi Co., Milwaukee, and R. B. Harvey, Novo Engine Co., Lansing, Mich.

Members of the Jack Industry Advisory Committee of WPB are Huston Brown, The Joyce-Cridland Co., Dayton, Ohio; Archibald Dudgeon, Richard Dudgeon, Inc., New York City; R. B. Fisher, The Buda Co.; W. I. Floyd, The Duff-Norton Mfg. Co., Pittsburgh; G. H. Goehrig, Blackhawk Mfg. Co.; H. C. Norman, Hein-Werner Motor Parts Corp.; R. F. Swett, A. L. Swett Iron Works, Medina, N. Y.; J. B. Templeton, Templeton-Kenly & Co., Inc., Chicago; Gordon Walker, Walker Mfg. Co., and A. G. York, The Watson-Stillman Co., Roselle, N. J. J. J. Donovan is the government presiding officer.

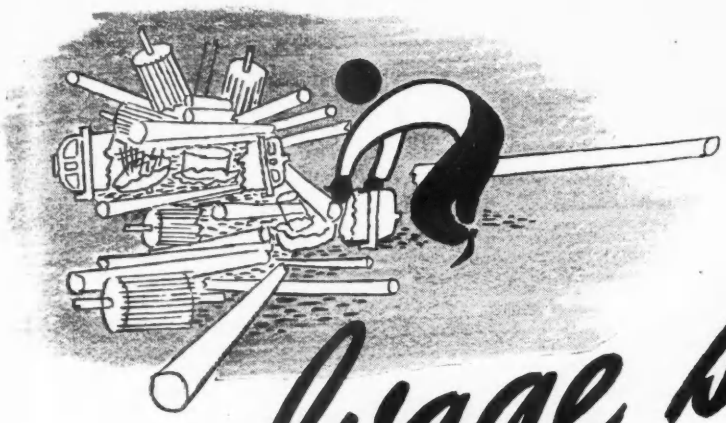


Marchev Elected President of Republic

Alfred Marchev, executive vice-president, will become president of Republic Aviation Corporation on September 1, succeeding Ralph S. Damon, who will retire from the company's highest executive position after more than two years of service. Mr. Damon will return to American Airlines, Inc., of which he will become vice-president and general manager. He has been Republic president since May 1, 1941.

Argentine Government Supervises U. S. Plants

The Argentine government has assumed supervision over six U. S. industrial plants, three automobile factories and three tire companies, by official decree. The action was taken to investigate charges that the companies were violating commercial laws. The plants were the Ford Motor Co., General Motors of Argentina and International Harvester Co. of Argentina. All operated as assembly plants before the war but the Ford plant had been closed down and the other two were engaged mainly in repair work. The tire factories, which had been working on decreasing supply of rubber since Pearl Harbor, were the Goodyear Pneumaitoc Sociedad Anonima, Firestone de la Argentina Sociedad Anonima and Michelin Sociedad Anonima Argentina de Neumaticos. Goodyear recently announced the opening of a new tire plant, its third in South America, at Lima, Peru.



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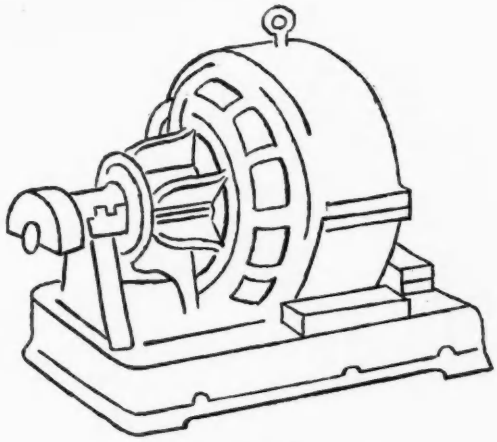


to replace broken shovel motor-shaft in one day's time

SHAFT ON 37 HP SHOVEL MOTOR SNAPPED AT 4:00 P.M. FRIDAY. MOTOR RECEIVED AT WESTINGHOUSE DISTRICT MANUFACTURING AND REPAIR PLANT 11:00 A.M. SATURDAY. STEEL FOR NEW SHAFT COULD NOT BE DELIVERED PROMPTLY. SEARCHED SALVAGE AND MACHINED LARGER MOTOR SHAFT TO CORRECT DIMENSIONS. MOTOR ASSEMBLED AND SHOVEL OPERATING AT 4:00 P.M. SUNDAY.

Westinghouse

DISTRICT MANUFACTURING AND REPAIR

J-90467

IF **THE EQUIPMENT NEEDING REPAIR IS VITAL TO THE WAR EFFORT . . . PHONE THE NEAREST OFFICE OF WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY FOR**

EMERGENCY SERVICE

33 M & R PLANTS . . . ONE NEAR YOU!

Advertising Notes

S. W. Munroe, General Sales Manager, recently announced that Chrysler Division of Chrysler Corporation plans to inform the public through advertising of its war activities. Chrysler Division is engaged in building a variety of war products including industrial engines, marine engines, marine tractors, Navy pontoons, anti-aircraft cannon parts, tank engine assemblies, airplane wing panels, fire fighting equipment, air raid sirens and searchlight reflectors.

"It is our feeling," said Mr. Munroe, "that a more complete understanding of our progress will be of general interest. Such reports as we make from time to time will be told in our advertising which will be released through McCann-Erickson, Inc."

The program contemplates the use of a representative list of national magazines and automotive trade publications.

The Goodyear Tire & Rubber Company has retained the firm of H. A. Bruno & Associates as public relations counsel. Mr. Bruno has named his associate, L. A. Nixon, as account executive. While the Bruno firm will serve in an over-all capacity, it will give especial attention to the aeronautical activities of Goodyear.

CALENDAR

Conventions and Meetings

SAE Transportation & Maintenance Meeting, San Francisco — Aug. 19-20
SAE Nat'l Tractor Mtg., Milwaukee, — Sept. 23-24
SAE Nat'l Aircraft Engineering & Production Mtg., Los Angeles, — Sept. 30-Oct. 2
National Safety Congress, Chicago — Oct. 5-7
American Welding Society, Chicago, — Oct. 18-23
National Metal Congress, Chicago — Oct. 18-23
SAE Fuels & Lubricants Mtg., Tulsa, — Nov. 4-5
SAE Annual Mtd. & Eng. Display, Detroit — Jan. 10-14

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

General business activity has remained fairly stable. *The New York Times* seasonally adjusted index for the week ended July 24 stands at 141.5, as against 139.8 for the preceding week and the all-time peak of 141.6, recorded in May.

Department store sales reported by the Federal Reserve Board for the week ended July 24 were 19 per cent above the corresponding level last year, this advance comparing with a gain of 20 per cent shown for the preceding week. Sales for the four weeks ended on that date were 18 per cent larger than a year ago, and the total for the year to date is 15 per cent above the comparable 1942 figure.

Railway freight loadings in the week ended July 24 totaled 883,826 cars, 0.7 per cent more than the figure for the preceding week and 3.3 per cent above the corresponding number last year.

Electric power production during the same period increased less than seasonally and was 15.7 per cent greater than a year ago. For the preceding week a comparable gain of 17.4 per cent was reported.

Crude oil production during the week ended July 24 averaged 4,118,700 barrels daily. This amount is 15,600 barrels above the figure for the preceding week and 428,100 barrels greater than production a year ago.

The production of bituminous coal in the week ended July 17 was officially estimated at 11,860,000 net tons, as compared with 11,170,000 tons a week earlier and 11,139,000 tons a year ago.

Engineering construction contracts awarded during the week ended July 29 amounted to $41,154,000, according to *Engineering News-Record*, and fell 84 per cent below the figure for the corresponding period last year. For 1943 to date, the total is 65 per cent less than the comparable sum in 1942.

Professor Fisher's index of wholesale commodity prices for the week ended July 30 stands at 110.2 per cent of the 1926 average, as compared with 110.6 a week earlier and 108.4 a year ago.

Member bank reserves declined $10,000,000 during the week ended July 28, and excess reserves dropped $170,000,000 to an estimated total of $1,020,000,000. Business loans of reporting member banks increased $10,000,000 during the same period but stood $1,140,000,000 below the total a year earlier.

SYLPHON
AIRCRAFT CONTROLS

★ ★ ★ ★

On Nearly Every American-Built Plane . . .

SYLPHON BELLOWS ASSEMBLIES OR COMPLETE CONTROL INSTRUMENTS

Sylphon Aircraft controls or instruments of other makes employing Sylphon Bellows and Bellows assemblies, fly with practically every American Plane.

For this light, strong, highly flexible and sensitive yet durable heart of so many aircraft devices is a "natural" for such services as Supercharger Controls, Carburetor Controls, Fuel Injector Controls, Automatic Exit Flap Controls, Damper Controls for Cabin and Wing Heating, Oxygen Regulators, Fuel Gauges, Fuel Tank Vent Valves, Fuel Transfer Valves, Bank and Turn Indicators, Liquid Cooled Engine Thermostats, Oil Cooler Surge Protection Valves, Oil Cooler Thermostats, Fuel Pressure Regulating Valves, Manifold Pressure Gauges, Anercid Assemblies, Landing Struts, Shaft Seals for Hydraulic Pumps plus a thousand and one other applications.

What are your requirements? The Fulton Sylphon Company's extensive engineering and manufacturing facilities are geared to meet the all-out demands of aircraft production. Your inquiries will receive immediate action.

SYLPHON PRODUCTS FOR THE AIRCRAFT INDUSTRY INCLUDE:

- Liquid Cooled Engine Thermostats
- Oil Cooler Thermostats
- Oil Cooler Surge Protection Valves
- Fuel Pressure Regulating Valves
- Damper Controls for Cabin and Wing Heating
- Bellows Assemblies for Supercharger Controls, Carburetor Controls, Fuel Injector Controls, etc.
- Shaft Seals for Hydraulic Pumps, etc.

ARMY E NAVY

THE FULTON SYLPHON CO.

KNOXVILLE, TENNESSEE

Temperature Controls . . . Bellows . . . Bellows Assemblies

ASU Offers Help In Placing Orders

A new program to assist aircraft manufacturers in placing brass and copper orders has been established by Aircraft Scheduling Unit with the cooperation of the brass and copper mills.

The new program will be handled by the Non-Ferrous Sub-Unit under Major M. C. Durbin, acting for the Aircraft Scheduling Unit. The Non-Ferrous Sub-Unit is a part of Lt. Colonel A. E. R. Peterka's Materials Distribution Branch, Resources Control Section, Materiel Command, with offices at Steele High Building, Dayton, Ohio.

Under present regulations, brass and copper mills will not accept orders from aircraft manufacturers when the mill capacity is filled, even though the order is covered with a CMP allotment number. Normally, the manufacturer would then be forced to check all the remaining mills in an attempt to place his order, thus losing valuable time.

To avoid this, the mills voluntarily offered to supply the Non-Ferrous Sub-Unit with weekly reports listing their open capacities. Any manufacturer, therefore, who is unable to place his order should immediately contact the Non-Ferrous Sub-Unit, giving complete information on the order to be placed.

This may be done by letter, telephone, or wire. It is not necessary to fill out any forms or questionnaires. In order to provide direct control and immediate action, this program will be handled directly by the Non-Ferrous Sub-Unit. Upon receipt of the proper information, the Non-Ferrous Sub-Unit will then check the list of open capacities and place the order orally with the mill on behalf of the manufacturer. The manufacturer will then confirm the action with a purchase order.

It is important that the manufacturer supply the Non-Ferrous Sub-Unit with complete details of the type of material desired and end use, since the Non-Ferrous Sub-Unit must have this information to determine where the order can be placed.

Whenever possible, the order will be placed the same day the request is received from the manufacturer and the Non-Ferrous Sub-Unit will notify the manufacturer immediately when the order has been accepted.

This new program was suggested by the mills themselves in an effort to offer maximum cooperation to industry and Government in securing vital brass and copper materials for aircraft production.

FOR DEFINITE DELIVERY DATES ON TURNER GAUGES..

SEND FOR THIS BULLETIN TODAY!

IT GIVES YOU UP-TO-THE-MINUTE PRODUCTION DATES ON:

PLUG • RING • SNAP • FLUSH PIN • BUILT UP •

Because all trade journal advertisements have to be prepared 30 days before publication date, it is impossible for the Turner Gauge Grinding Company to publish accurate delivery dates in their advertisements. That is the reason why Turner asks you to write for the "Turner Bulletin" which is issued each month just after the publications are sent out. In this way, Turner is able to check their latest production schedules, so that they can give you up-to-the-minute delivery dates on their gauges, thereby assuring you of definite deliveries.

IMPORTANT

Let us put you on our mailing list so that you will be sure to receive this important bulletin each month. Send your name today!

TURNER BROTHERS

TURNER GAUGE GRINDING COMPANY
2622 HILTON ROAD • • • • FERNDALE, MICH.

Ford Resumes Farm Tractor Production

Ford Motor Co. is resuming production of farm tractors in August following a closedown since last March. Remainder of the 1942-43 quota, based on 25 per cent of 1941 output, will be produced in August and September. Production will continue through next March, however, with the 1943-44 quota, based on 41 per cent of 1941 output, beginning in October.

Little Jack Horner

"If the war program has broken down at any point, if it has failed to keep the pace that had been hoped for, it hasn't been chargeable to the brain-trusters, to the new dealers or to the bureaucrats."
—Harold L. Ickes, Washington new dealer.

The War...And You!

Friend—don't think this war doesn't affect you. It does. It's pushing the world twenty years ahead of time; stimulating the development of devices you may now be making or using. After the war, the average American's life is destined to be fuller, more exciting, more comfortable due to these new products. And just as Weatherhead has helped build the nation's automobiles, airplanes and refrigerators in the past, peace will find us prepared to join you in building these established products as well as the many new ones certain to come out of the war.

Look Ahead with

Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO

Manufacturers of vital parts for the automotive. aviation, refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles
Canada—St. Thomas, Ontario

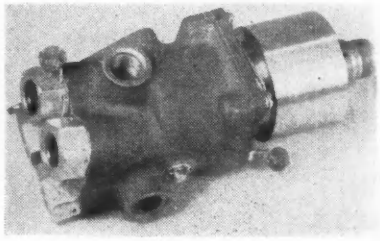
New Products for Aircraft

Solenoid-Operated Reversing Valve

To stop the motion of aircraft gun turrets and thus prevent the turret gun coming in contact with some part of the plane, Adel Precision Products Corp., Burbank, California, has developed a solenoid-operated instantaneous reversing hydraulic valve. A feature of the valve is its positive and instantaneous action. Operating automatically, it stops and reverses the motion of the turret in 1/20 of a second.

The new valve was developed at the request of a major airplane manufacturer. It was originally designed as a turret interrupter, but can be used in any case where it is desired to stop and reverse a movement before a predetermined danger point is reached.

The unit operates electrically, by means of a solenoid. Just before the desired "stop" position of the turret is reached, an electrical circuit is closed, energizing the solenoid, which trips a cam in the valve unit. The action of the cam closes the normal openings of the valve and opens the operating openings, reversing the flow of the hydraulic fluid and consequently the motion of the turret. When the turret has moved two inches in the reverse direction, the valve automatically returns to normal position and the turret resumes normal operation.



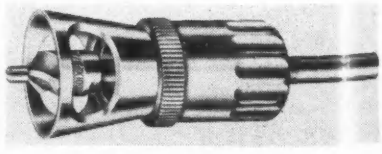
Adel Reversing Valve

The complete valve weighs 3.24 lb. Overall dimensions are: 2¾ in. by 2¾ in. by 6 7/16 in. The solenoid is operated on 24 volts, and draws approximately 15 amps.

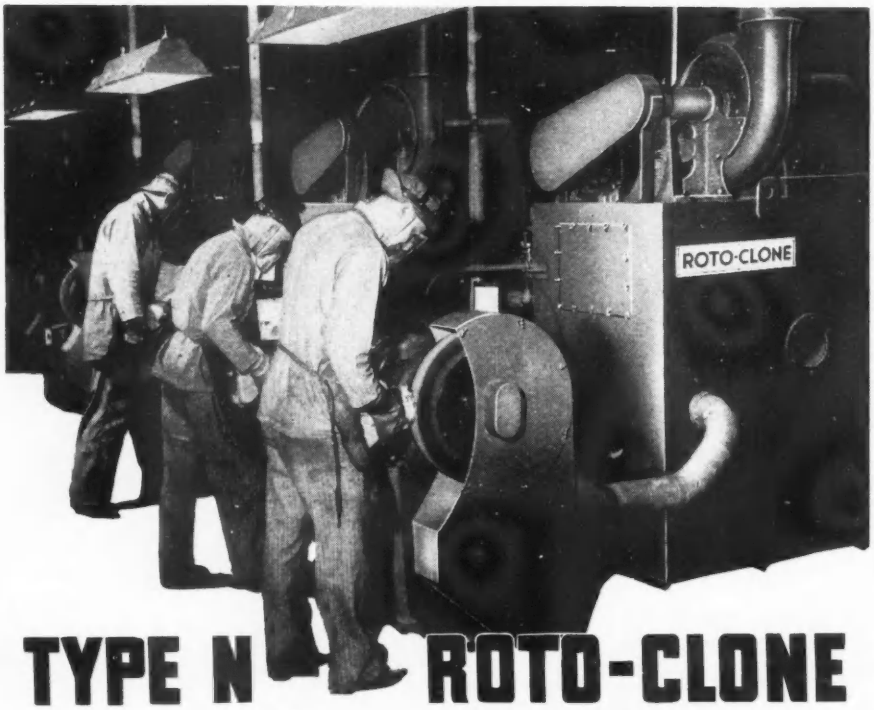
New Adjustable Stop-Countersink

A new adjustable stop-countersink, the Model C, has been placed on the market by Aircraft Tools, Inc., Los Angeles, Cal. The shell housing is bell

(*Turn to page* 154, *please*)



Model C Adjustable Stop-Countersink.



TYPE N ROTO-CLONE
provides SAFE-POSITIVE control
of magnesium grinding dust

In order to provide absolute safety in the handling of magnesium dusts AAF engineers have developed the Type N Roto-Clone which precipitates the dust under liquid and stores it as sludge.

The Type N is available as a complete self-contained dust collector suited for individual grinding stands, buffers or polishers or in large sizes for serving a central system exhausting from a number of dust sources.

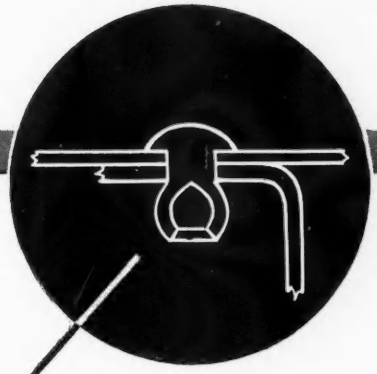
The individual stand Type N Roto-Clone collectors illustrated above exhaust the cleaned air back into the workroom and are now in use in a large mid-western magnesium foundry.

If you have a magesium dust problem write for Bulletin No. 277 which will be sent without obligation.

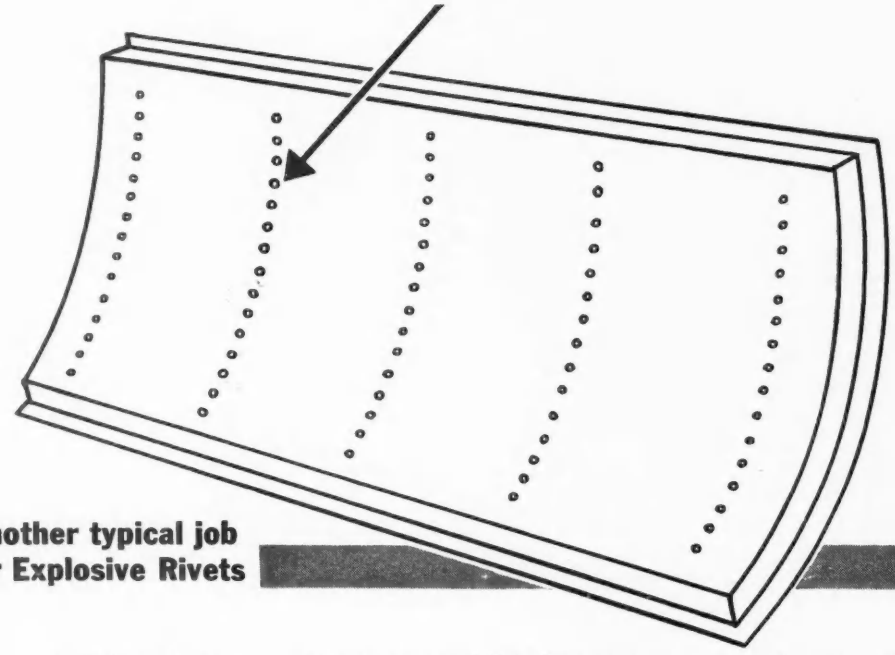
BUY WAR BONDS

AAF AMERICAN AIR FILTERS

AMERICAN AIR FILTER CO., INC.
INCORPORATED
449 CENTRAL AVE. LOUISVILLE, KENTUCKY
IN CANADA, DARLING BROTHERS, LIMITED, MONTREAL, P. Q.



APPLYING THE INNER SKIN OF A BOMB-BAY DOOR—*FAST!*



Another typical job for Explosive Rivets

When it comes to blind riveting inner skins on bomb-bay doors, nacelle doors, covers across access holes and many other jobs, Du Pont Explosive Rivets go a long way toward speeding up the work.

One operator using only one tool can easily set from 10 to 20 Explosive Rivets per minute. You simply touch the rivet head with the tip of the Du Pont Riveting Iron. This detonates a tiny charge in the end of the rivet. A blind head is formed, setting the rivet securely in place. No further operations are necessary to complete the job.

The solid shank of Explosive Rivets, as the detail view clearly shows, provides strength where it is needed.

Look into this fast, modern way of blind riveting. It saves man-hours, trims down costs and gives you a better, stronger completed job. Write for descriptive literature on "How to Use Explosive Rivets."

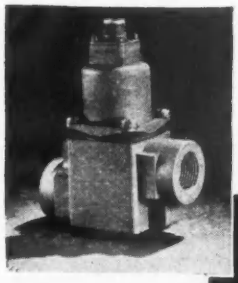
E. I. du Pont de Nemours & Co. (Inc.), Explosives Dept., 5494-H Nemours Bldg., Wilmington, Del.; 5-236-H General Motors Bldg., Detroit, Mich.; 5801-H So. Broadway, Los Angeles, California.

DU PONT
REG. U. S. PAT. OFF.

EXPLOSIVE RIVETS

The one-piece blind fastener with a solid shank

GENERAL CONTROLS
hi-g*
GASOLINE SHUT-OFF VALVES



Above: Type AV-6; ¾" and 1" full flow valve for gasoline cross feed.

Below: Type AV-5; electric diaphragm gasoline valve.

Above: Type AV-12; gasoline safety shut-off valve.

AVAILABLE UP TO 2" IN SIZE WITH HIGH FLOWS AND LOW HEAD LOSS

General Controls hi-g electromagnetic Shut-off Valves not only assure automatic and remote gasoline flow control but also simplify gear, electrical circuits, and pilot supervisory operations. They are available in a range of AN pipe sizes up to 2", with a wide range of AN electrical connectors. Because of the varied specifications, one of these three types of valves is sure to meet the requirements of most applications. Complete specifications are available upon request. Write or wire our engineering department today.

Other General Controls hi-g electric aircraft valves include oil, anti-icing and cabin heater controls, high pressure hydraulic controls, including 3- and 4-way selector valves, etc. Write for descriptive, factual Bulletin.

*TRADE MARK—hi-g indicates positive ability to operate in any position, regardless of vibration, change of motion or acceleration.

GENERAL CONTROLS

PIONEERS AND LEADERS IN THE DEVELOPMENT AND MANUFACTURE OF MAGNETIC VALVES

801 ALLEN AVENUE, GLENDALE 1, CALIFORNIA

BOSTON • NEW YORK • PHILADELPHIA • DETROIT
CHICAGO • CLEVELAND • DALLAS • SAN FRANCISCO

Producer Gas for Motor Transport

(*Continued from page* 44)

The difficulty of keeping the fire alight during long stops, the dust and dirt encountered when fueling and cleaning, the time taken for starting (particularly if the gas is wet), the difficulty of finding space on the chassis or of maneuvring in traffic if a trailer is used, and above all, the loss of power and flexibility, make it improbable that gas producers will become popular with the owners of private cars.

Their application would appear to be more directly to trucks or fleets of trucks, where they can be kept in condition by a service staff. Both the British and Australian reports emphasize the necessity of adhering to standard dimensions, and state most distinctly that the design and fabrication of gas producer plants should not be undertaken by amateurs, but should be in the hands of experienced personnel.

The cost of such a plant is in the neighborhood of $300-$500 and the average weight of metal 400-600 lb. This is mostly steel, and assuming an average of 500 lb of mild steel per vehicle, 25,000 tons would be necessary to equip 100,000 vehicles.* In addition to this, if trailers are employed, an additional 25,000 tons of steel would be required for the trailers, and 200,000 tires would have to be provided.

The report of the Chemurgic Committee states that, in 1940 motor fuel consumption in Canada was nearly 900 million gallons, and it was estimated that 45 million bushels of wheat would be required to replace 10 per cent of this amount by alcohol. Considering 12 lb of charcoal as equivalent to one gallon of gasoline, an annual consumption of 540,000 tons of charcoal would be necessary for the same purpose. These factors may be decisive under war conditions.

*This is slightly less than half the number of trucks registered in Canada in 1940.

Synthetic-Treaded Bus Tires Pass Long Test

Completion of the most comprehensive tests to date of heavy-duty synthetic-treaded tires, covering a full year of operation on buses of the Public Service Coordinated Transport in New Jersey, was announced by United States Rubber Company.

The synthetic used in the tires was buna S, the chief type being manufactured in the government's new synthetic rubber plants.

Consistent improvement was shown in the product during the year, U. S. Rubber engineers said, with mileage running as high as 37,000 miles per tire.

They pointed out, however, that each tire was built in four sections, with a different compound in each. When one of these sections was worn through the tire was removed from the bus. Therefore, the mileage established represented that of the worst section, while rubber remained on the others.

The test routes were selected to furnish every type of road and operating condition.

There were no failures during the entire experiment from any cause other than normal wear, the company said. Synthetic tubes and flaps were likewise used in the experiment with satisfactory results. Most of the tires used in the New Jersey test were of the rayon type.

Better
TOOLS and GAGES
through inspection by optical projection with Jones & Lamson COMPARATORS

THE inspection and measurement of tools, gages, production parts and products by optical projection with **Jones & Lamson Optical Comparators** has been the solution of many an inspection problem, and has resulted in better tools and gages and substantial savings in costs.

There is a **Jones & Lamson Comparator** for every need in the field of inspection by optical projection. These machines are *designed with a thorough understanding of shop practice, to meet shop requirements,* and built with all the care, accuracy and precision that so long have been the tradition of this company.

Jones & Lamson Inspection Engineers are ready to study your inspection problems and make recommendations based upon over twenty years of experience in the development of **Comparators** for inspection by optical projection.

Universal Turret Lathes . Fay Automatic Lathes . Automatic Thread Grinders . Optical Comparators . Automatic Opening Threading Dies

JONES & LAMSON MACHINE CO., SPRINGFIELD, VERMONT, U.S.A.

Profit-producing Machine Tools

Obituary

O. J. Mulford, 75, president of the Gray Marine Motor Co., Detroit, died Aug. 3 in Detroit after a long illness. He was an automobile advertising pioneer, his agency preparing some of the first advertisements for Ford and Packard. With Henry B. Joy he coined the famous Packard slogan, "Ask the man who owns one." He was one of the organizers of the Gray Motor Co., manufacturer of engines, in 1906. This later became a unit of the U. S. Motors Corp. Later he was president of the King Motor Car Co.

Allan Seymour, Philadelphia district manager for the Abrasive Division of Norton Company, Worcester, Mass., died July 30. He had been with Norton Company for 25 years and in charge of the Philadelphia branch since December, 1934. Previously, he was manager of the Hartford district and head of the Sales Engineering Department at Worcester.

Samuel J. Eberwein, 47, assistant superintendent of The Electric Furnace Company, Salem, Ohio, for the past 20 years, died at his home in Salem on July 21. Mr. Eberwein, who was widely known throughout the industry, was born June 12, 1896, at Slatington, Pennsylvania, and was a graduate of Penn State University, College of Engineering.

Maj. William B. Robertson, 49, president of the Robertson Aircraft Corp., St. Louis, and Harold H. Krueger, vice-president and general manager of the company, were among 10 persons killed in the crash of an Army cargo-carrying glider at a ceremonial demonstration Aug. 1 at the Lambert-St. Louis Airport.

Frederick P. Wessolek, 56, general superintendent of the Ohio Crankshaft Co., died July 28 at Cleveland. He was the first employe of the company in 1920, working his way up from machine operator to superintendent.

War Plant Expansions

Ford Motor Co. has been granted an increase of $3,400,000 for additional plant facilities in Michigan by the Defense Plant Corp., boosting the total commitment to $86,000,000. Murray Corp. of America has had its contract increased by $1,800,000 for additional facilities at Detroit and Scranton, Pa., resulting in an overall commitment of $7,300,000. Nash-Kelvinator Corp. has had a $1,660,000 increase for additional facilities at a plant in Michigan.

Consolidated Vultee Aircraft Corp. has received an increase of $5,500,000 for additional facilities at a plant in New Orleans, making the total commitment $11,300,000. Bell Aircraft Corp. has been granted an increase of $450,000 in a DPC contract for additional facilities at a plant in New York State, bringing the total to $22,500,000. Bell also has received a new contract for $2,000,000 to provide facilities in Vermont.

He's On Our Side Now

Martin Fleischmann, German aviator in World War I, has developed a new special steel for use in a vital supercharger part. He has been in charge of the Metallographic Laboratory of The Timken Roller Bearing Company since 1928

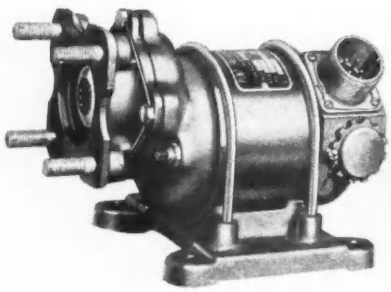
Check THESE POINTS
ON SPECIAL APPLICATION MOTORS
WHEN DEVELOPING A NEW PRODUCT

• When discussing the motor for your new product, we suggest that you give careful consideration to the following points:

1. What suppliers have had the most experience in the design and manufacture of special application (fractional horsepower) motors?
2. What companies are best qualified to assume complete responsibility for the motor design or will cooperate with our engineering department?

After presenting their problem to us, many manufacturers have found that we fulfill both these important requirements.

THE BLACK & DECKER ELECTRIC CO.
KENT, OHIO



THOROUGH ENGINEERING is the basic factor behind the successful operation of this aircraft fuel pump motor and many other special application motors we have designed for all types of equipment.

Black & Decker
FRACTIONAL HORSEPOWER SPECIAL APPLICATION MOTORS

The demands of wartime aviation insure better peacetime performance

McQUAY-NORRIS
ALTINIZED
PISTON RINGS

PISTONS..PINS..
HARDENED & GROUND PARTS

War demands new and higher standards of performance and stamina in aviation parts. McQuay-Norris with a third of a century experience in making automotive precision parts is now extending its services to the aviation industry in increasing measure. McQuay-Norris' policy of clinical research is carried out by our Aircraft Division which offers the industry various precision parts, technical assistance and research experience. Your inquiries are invited.

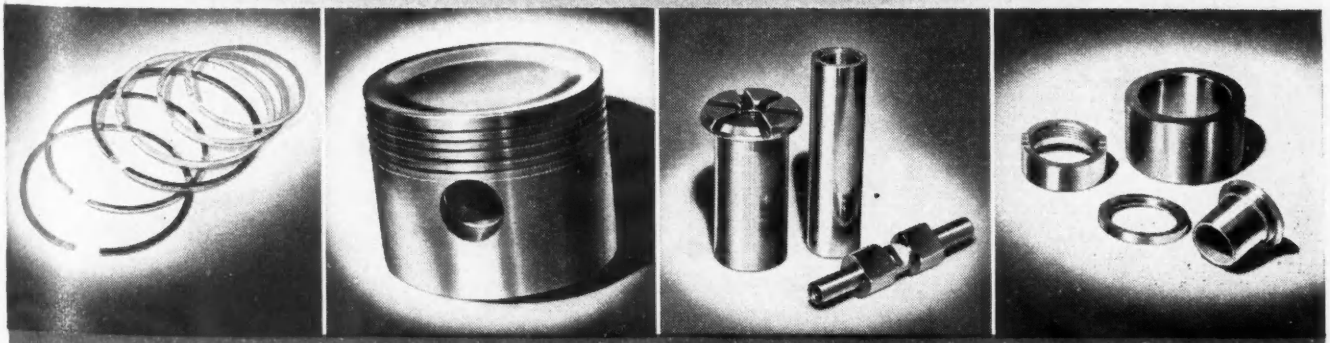
PARTS FOR AIRCRAFT ENGINES
Piston Rings
Oil Sealing Rings
Supercharger Rings
Carburetor Parts
Machined Aluminum Pistons
Piston Pins
Counterweight Cheek Pins
Machined Magnesium Parts
Cylinder Hold Down Nuts
Hardened and Ground Parts

PARTS FOR PROPELLER ASSEMBLY
Machined Magnesium Parts
Piston Rings

EQUIPMENT FOR MAINTENANCE OF AIRCRAFT
Pistons for Oxygen Compressor
Piston Rings for Oxygen Compressor
Pins for Oxygen Compressor
Pistons for Air Compressor
Pins for Air Compressor
Piston Rings for Air Compressor

LANDING GEAR PARTS
Machined Aluminum Pistons
Piston Rings
Hardened and Ground Parts

PRECISION WORKERS IN IRON, STEEL, ALUMINUM, BRONZE, MAGNESIUM



McQUAY-NORRIS MFG. CO. (AIRCRAFT DIVISION), ST. LOUIS, U. S. A.
CANADIAN PLANT, TORONTO, ONTARIO

BOOKS . . . .

With the increasing use of electric resistance welders for joining a variety of metals, particularly of aluminum and its alloys, the automotive industry has adopted electron-tube controls in ever-increasing numbers on equipment such as Sciaky welders and Taylor-Winfield welders, just to cite two examples. It is therefore of timely interest to find a text entitled "ELECTRONIC CONTROL OF RESISTANCE WELDING" written by *George M. Chute, applications engineer, General Electric Co.* It is based upon a course of instruction for war workers in Detroit, supplemented with material gathered from recent technical papers prepared by a group of General Electric engineers. It is said to be a simple and practical exposition of electron tubes and circuits which may be of general interest to those who need a basic introduction to electronics without resorting to technical detail. The text covers the design, operation, and maintenance of synchronous timers as well as stored-energy controls; deals primarily with GE equipment now in wide use.

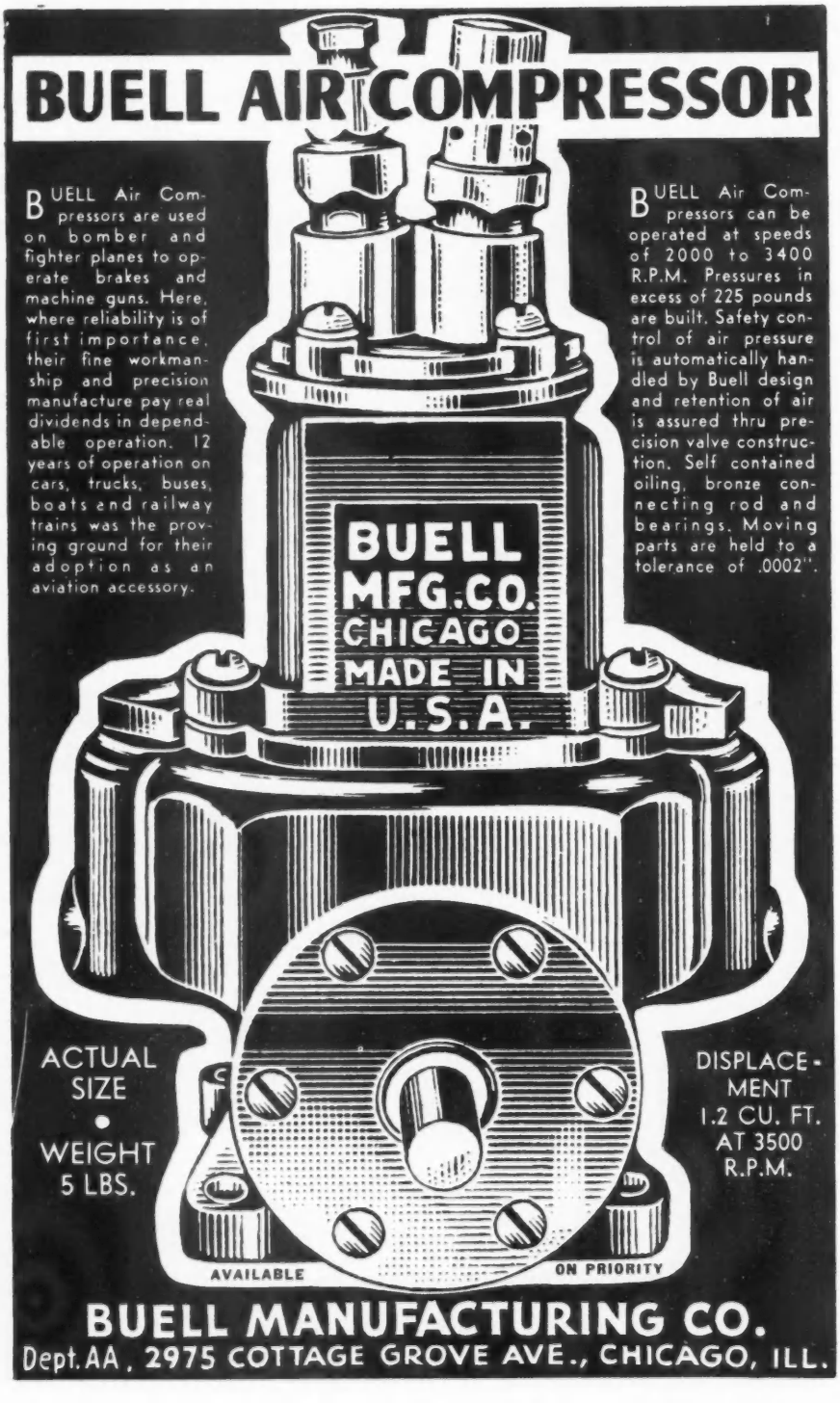
Because of widespread demand by technicians, pilots, pre-flight students, aircraft workers, civilian observers, air raid wardens and many others—publication of the second edition of MODERN AIRCRAFT, the international aircraft section of AEROSPHERE, International Aviation Authority, has just been announced by *Aircraft Publications, 370 Lexington Avenue, New York.*

Edited by *Glenn D. Angle*, the new volume contains 416 pages, with 590 illustrations; is bound in red buckram, has a page size of 8½ x 11½ and costs $7.50 plus shipping charges.

Last year, the pubishers of Aerosphere, as an experiment, decided to issue the aeroplane section separately. It met with such immediate success that it was decided to issue the separate volume again this year.

In addition to all the aircraft material from AEROSPHERE, it also contains a 16-page supplement presenting the more important planes which have appeared since the original printing.

MODERN AIRCRAFT presents photographs, detailed drawings, and complete available descriptions of the design, construction, performance, armament, armor, speed, range, instruments, etc., of airplanes manufactured throughout the world, including the military, commercial and private planes of the United States, Germany, Russia, Italy, Britain, Japan and 22 other countries.

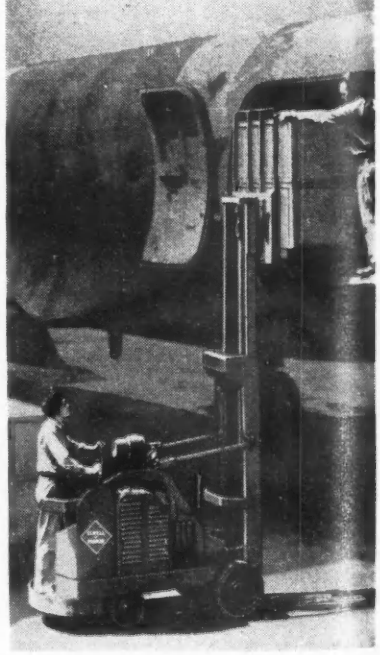

BUELL AIR COMPRESSOR
BUELL Air Compressors are used on bomber and fighter planes to operate brakes and machine guns. Here, where reliability is of first importance, their fine workmanship and precision manufacture pay real dividends in dependable operation. 12 years of operation on cars, trucks, buses, boats and railway trains was the proving ground for their adoption as an aviation accessory.
BUELL Air Compressors can be operated at speeds of 2000 to 3400 R.P.M. Pressures in excess of 225 pounds are built. Safety control of air pressure is automatically handled by Buell design and retention of air is assured thru precision valve construction. Self contained oiling, bronze connecting rod and bearings. Moving parts are held to a tolerance of .0002".
BUELL MFG. CO. CHICAGO MADE IN U.S.A.
ACTUAL SIZE • WEIGHT 5 LBS.
DISPLACEMENT 1.2 CU. FT. AT 3500 R.P.M.
AVAILABLE ON PRIORITY
BUELL MANUFACTURING CO.
Dept. AA, 2975 COTTAGE GROVE AVE., CHICAGO, ILL.

Lockheed Aircraft Production Doubled

Production and services of Lockheed Aircraft Corp. and subsidiaries in the first half of 1943 approximated $330,000,000, or double the output of the Lockheed and Vega factories in the corresponding period last year, Robert E. Gross, president, informed stockholders in an interim report.

Because prices on products delivered to the government during the period have not been negotiated, profits indicated on the company's books are to a degree meaningless, Gross declared. He described the percentage of profit on sales, after reserves and taxes, as approximately the 2½% shown for the first half of 1942.

Reduces Loading Time



This modern method of loading cargo planes requires only two men to raise or lower a half ton of freight. It reduces ground time from hours to minutes. The equipment is manufactured by The Elwell-Parker Electric Company, Cleveland, Ohio.

Propeller Blade Output Increased

Production of aircraft propeller blades during the first six months of this year by American Propeller Corporation, subsidiary of The Aviation Corporation, was nearly two and one-half times greater than in the last half of 1942. The company's backlog of orders is now almost twice what it was a year ago.

Three models of the hollow steel type propeller blade manufactured exclusively by American Propeller at Toledo are now in production, compared to the single model being made when the company opened its new plant in May, 1942. Other types are under development and the company's rate of production during the last half of 1943 is expected to be substantially increased.

ARMY E NAVY

Awards

Names and winners of Army-Navy "E" awards in or allied with the automotive and aviation industries, announced since the August 1 issue of *Automotive* and *Aviation Industries* went to press.

-AERONCA AIRCRAFT CORPORATION, Middletown, Ohio.
ALLIS-CHALMERS MANUFACTURING COMPANY, La Porte, Ind.
AMERICAN CAR AND FOUNDRY COMPANY, Berwick, Pa.
AMERICAN CYANAMID & CHEMICAL CORPORATION, Little Rock, Ark.
APCO-MOSSBERG COMPANY, Attleboro, Mass.
ATLAS IMPERIAL DIESEL ENGINE COMPANY, Mattoon, Ill.
BELLE CITY MALLEABLE IRON COMPANY, Racine, Wis.
BENDIX AVIATION CORPORATION (J. P. Friez & Sons Div.) Towson, Md.
CENTURY BOAT COMPANY, Manistee, Mich.
CHICAGO WHEEL & MANUFACTURING COMPANY, Chicago, Ill.
COPPERWELD STEEL COMPANY, Glassport, Pa.
DETROIT HARVESTER COMPANY (Dura Div.), Toledo, Ohio.
FANSTEEL METALLURGICAL CORPORATION, North Chicago, Ill.
FORD MOTOR COMPANY (Richmond Tank & Motor Vehicle Depot), Richmond, Cal.
GATES RUBBER COMPANY, Denver, Colo.
THE HEIL COMPANY, Milwaukee, Wis.
INDIAN MOTOCYCLE COMPANY, Springfield, Mass.
JUBILEE MANUFACTURING COMPANY, Omaha, Neb.
LINK BELT COMPANY, Chicago, Ill.
MODINE MANUFACTURING COMPANY, Racine, Wis.
SPICER MANUFACTURING COMPANY (Pottstown Plant), Pottstown, Pa.
STEEL PRODUCTS COMPANY, INC., Savannah, Ga.
UNITED STATES SPRING AND BUMPER COMPANY, Vernon, Cal.
WEST MICHIGAN STEEL FOUNDRY COMPANY, Muskegon, Mich.

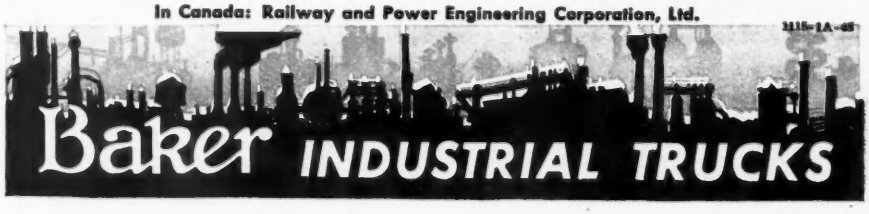
For Increased Production and Efficiency

Another forward step in providing faster, safer, and better movement of material has been made by Baker Trucks. This new Low-Lift model, designated as Type E-3, is of 6000 lb. capacity. The improvements consist of hydraulic lift, increased battery capacity permitting longer continuous operation, chamfered front top corner of battery compartment improving driver's visibility, operator's guard integral with frame for greater strength and safety, and other features which provide increased efficiency and easier maintenance ...The new improved design is also available in 4000 lb. capacity (Type E-2). Write for complete information.

NEW Baker Low-Lift Truck has these advantages:

1. Hydraulic lift system proved by experience in other Baker Trucks, providing positive control of hoisting and lowering.
2. Larger battery box (32" x 39½") permitting enough additional battery capacity so that trucks can be operated continuously for longer shifts.
3. Streamlined design of battery compartment providing greater visibility for operator.
4. Sliding type battery cover equipped with handles for faster servicing.
5. Operator's guard built integral with frame for greater strength and safety and improved appearance.
6. Handy compartment for carrying towing chain, pinch bar, or other tools.
7. Controls in a conveniently accessible panel providing easy maintenance.
8. Alloy-steel trailing axle firmly anchored to frame, wheels steering on anti-friction bearings. Box-section frame to withstand strains and minimize maintenance.
9. Single hex nut for adjusting travel brake located where it can be easily reached.
10. Standard Baker-built travel motor, and exclusive Baker Duplex-Compensating Suspension for smoother running and longer life.

BAKER INDUSTRIAL TRUCK DIVISION *of the Baker-Raulang Company*
2154 WEST 25th STREET • • • • CLEVELAND, OHIO
In Canada: Railway and Power Engineering Corporation, Ltd.



PUBLICATIONS

E. F. Houghton & Co. has brought out Volume 2 of their series of publications titled **War Production Data from The Houghton Line.** The subjects covered are the prevention of rust on war products shipped to all parts of the world: the final casing of high-speed steel tools considered from the point of view of getting the maximum length of life from such tools; cutting fluids for magnesium alloys; circulating quenching oil and a number of helpful short items grouped under the heading Production Briefs.*

General Electric's complete line of **arc-welding accessories** is described in a new 36-page booklet issued by the company's welding division. Featured in the well-illustrated publication is the full G-E line of chrome-leather, asbestos and flame-proofed-duck protective clothing for both men and women operators. Ventilated helmets and head protectors, electrode holders, etc., are also described and illustrated.*

Erie wheels, brake drums and parts are described and illustrated in a new catalog, No. 743, issued by Erie Malleable Iron Co. It is designed primarily for the use of truck, trailer and bus manufacturers, distributors, dealers, etc., and contains all essential information regarding current Erie wheel products.

Cannon Electrical Development Co. has released a new bulletin on **Cannon Type DP Rack and Panel Electrical Connectors.** It contains descriptions, applications, illustrations, sketches and tabular data on Types DP-D, DP-B, DP-R and other types used in a variety of applications in radio and instrument installations in aircraft, etc.*

A new folder, No. 143, on **heat transfer equipment** for every application, has been issued by Young Radiator Co. Aeronautical heat transfer equipment used in military and commercial aircraft is described and illustrated, together with condenser units, etc.*

The **No. 100 Series Sheffield Precision Thread Grinder** is described and illustrated in Bulletin M-100-143, issued by The Sheffield Corp. Included also is a table of specifications for all models of the No. 100 series.*

Carboloy Co., Inc., has made available a technical bulletin, No. GT-158, giving complete specifications of a new higher capacity and more flexible chip breaker grinder. Included are photographs and descriptions showing how to use the machine for grinding both angular and parallel type chip breakers.*

Carboloy has also issued a 20-page booklet giving an outline of free training courses in carbide die servicing. Courses are available to selected individuals in mills using cemented carbide dies.*

Bulletin No. 401, describing **Hammond Rotary Table Automatics** is announced by Hammond Machinery Builders, Inc. Automatic finishing is described and illustrated —construction features are given and a complete table of specifications.*

A new 21 by 30 inch wall chart, **A Guide for Spark Testing Tool Steels,** has been announced by The Carpenter Steel Co. It describes and illustrates spark patterns caused by various alloying elements in tool steel. Also given are complete details on the fundamentals of spark testing, instructions on grinding wheel speeds, etc.*

The Denison Engineering Co. has issued a bulletin describing and illustrating the range of hydraulic units manufactured by them. A complete page is devoted to HydrOILic Aircraft testing equipment.*

A 4-page illustrated bulletin on **Dag colloidal graphite** for impregnation and surface coatings has been released by the Acheson Colloids Corp. It is a detailed discussion of the impregnating capacity of colloidal graphite dispersions and the application and results of impregnation and surface coating of colloidal graphite for various industrial products.*

A new manual on **hard-surfacing** has been issued by the Office of Defense Transportation, Washington, D. C.*

Oakite Products, Inc., has issued a new 6-page **Special Service Report** telling how plating departments and contract finishing shops can speed-up the cleaning of metal surfaces and minimize or eliminate rejects before the application of protective zinc coatings. Helpful tips and suggestions are also given on the use of pickling treatments and acid baths for removing oxide, scale and rust.*

A new text book **Foremanship and Accident Prevention in Industry,** has been published by American Mutual Liability Insurance Co., 142 Berkeley St., Boston, Mass. It is designed to teach foremen accident prevention but is arranged to fit into any foreman's over-all training course.

Monsanto Chemical Co. has brought out a new booklet giving technical facts for the postwar product designer, and telling what plastics are, how they are used, etc. Included are diagrams illustrating how plastics are molded, charts comparing the characteristics of principal basic types, photographs of typical war and prewar uses and diagrams explaining some of the latest advances in plastic fabricating technique.*

* Obtainable by subscribers within the United States through Editorial Dept. Automotive and Aviation Industries. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

The Cherry Blind Rivet makes it highly practical for the engineer to design up to efficiency without too many worries about how a riveted product can be fabricated. Cherry Rivets make blind riveting fast and easy. They have high shear and fatigue values so they may be used in either primary or secondary structures.

The speed of factory operations makes an appreciable saving in manufacturing costs. In field repair Cherry Rivets save time, where time counts most.

CHERRY RIVETS, THEIR MANUFACTURE AND APPLICATION ARE COVERED BY U. S. PATENTS ISSUED AND PENDING.

The complete story on Cherry Rivets is clearly presented in the Handbook A-43. Request your copy today, Department A-109, Cherry Rivet Co., Los Angeles 13, Calif.

Cherry Rivet Company
LOS ANGELES, CALIFORNIA

Streaking through the water at speeds of 60 miles an hour, PT Boats pack more speed and hitting power for their size than any other naval craft afloat. Their capacity to deal death and destruction — like a thunderbolt — makes them one of Uncle Sam's most feared killers of the sea.

★ ★ ★

Double Over-Arms Provide a DUAL ADVANTAGE in Milwaukee Milling Machines

Rigidity and convenience—the Milwaukee double over-arm — scores heavily on both counts . . . No other means of arbor support is quite the equal of the double over-arm in *rigidity* — an indispensable quality in any milling machine.

No other means of arbor support affords quite the same quick and easy access to the milling cutter — just a few simple motions and both cutter and arbor are free — an important convenience to the operator at all times.

KEARNEY & TRECKER
CORPORATION
MILWAUKEE 14, WISCONSIN

Buy Victory
with at least 10% in War Bonds!

Milwaukee MACHINE TOOLS

MEN . . . . . .

E. B. Newill has been appointed general manager of the Allison division of General Motors Corp. succeeding **F. C. Kroeger,** who has been granted a leave of absence due to illness. Newill formerly was assistant to E. F. Johnson, vice-president in charge of the Dayton and Eastern Aircraft divisions of General Motors Corp. **Cyrus R. Osborn** has been elected a vice-president of General Motors in charge of the electro-motive division. He formerly was assistant to R. K. Evans, General Motors vice-president in charge of the general engine group. **A. W. Phelps,** formerly assistant general manager of the electro-motive division, has been named to succeed Newill in Detroit as assistant to Johnson.

Elliott Taylor, formerly assistant chief, has been appointed chief of the automobile rationing branch of OPA. He is on leave of absence from the Chevrolet motor division of General Motors Corp. Taylor succeeds **Hubert G. Larson** who is returning to his position with the motors holding division of General Motors Corp.

William B. Corbett, formerly associated with Ford, Hupmobile and Chrysler in various engineering capacities, has been named plant engineer of Willys-Overland Motors, Inc. **George Bluth,** a member of the inspection staff of General Motors Corp. for 15 years, has been appointed general chief inspector.

D. C. Fenner, public relations director, has been appointed acting manager of the sales promotion department of Mack Trucks, Inc.

Ray A. DeVlieg, vice-president, has been advanced to vice-president in charge of manufacturing by Nash-Kelvinator Corp. **Harold E. Long,** formerly director of purchases, has been named works manager in charge of Kenosha operations.

Albert C. Nute, formerly director of public relations for Graham-Paige Motors Corp., has been appointed manager of the press bureau of Hudson Motor Car Co. He succeeds **J. D. M. White,** who has joined the Detroit office of Ruthrauff & Ryan, Inc.

Robert M. Ross, formerly with the Detroit *Times*, has joined the public relations dept. of the Studebaker Corp.

Hugo A. Weissbrodt has resigned as deputy director of the Detroit regional office of WPB to return to International Harvester Co. for a special assignment related to war production. Weissbrodt was manager of the Springfield, Ohio, plant of International Harvester before he was loaned to WPB in February, 1942.

Frank E. Farrell, formerly sales promotion manager, has been appointed manager of the Detroit office of Howell Electric Motors Co.

Howard O. Ward, formerly advertising manager of the Chrysler Export Corp. and the Hudson Motor Car Co., has been appointed manager of the new Detroit office of Beaumont & Hohman, Inc., Chicago advertising agency. Among the accounts he will handle will be that of Graham-Paige Motors Corp.

Lyman W. Slack, acting general sales manager, has been named sales manger of the car and service division of Packard Motor Car Co.

R. R. Rees, formerly manager of construction and maintenance, has been named general manager of the new Toledo division of Packard Motor Car Co. **K. R. Parker,** formerly construction engineer in the Packard aircraft engine division, will succeed Rees.

Announcement has been made of the appointment of **Fred M. Young** as vice-president and member of the board of directors of Western Metals Specialty Mfg. Co. Mr. Young is associated with the Young Radiator Company, of Racine, and will continue to devote the greater part of his time to that company.

Promotion of two executives of Koppers Co., American Hammered Piston Ring div., has been announced. **A. E. Koether,** works manager since 1936 has been made technical assistant to **Allen W. Morton,** Koppers vice-president and general manager of the division. **Edgar S. Freeman, Jr.,** assistant sales manager, succeeds Mr. Koether as works manager.

Harvill Corp., Los Angeles, has announced the election of **C. K. Pistell** as president and **Paul R. Jordon** as general manager of the company.

George D. Ramsey has been appointed director of technical laboratories and materials development at the Kaiser Co., Iron and Steel div., Fontana, Calif.

Ferris R. Miller has been appointed vice-president in charge of industrial and public relations for Aircraft Tools, Inc., Los Angeles.

Charles D. Truman has been appointed public relations director of Interstate Aircraft and Engineering Corp., California and Illinois.

L. Paul De Loreto has been appointed traffic manager of Lecrone-Benedict Ways, Inc. He was formerly director of traffic for the George F. Alger Co., Detroit.

The appointment of **Ralph J. Cordiner** as assistant to the president of General Electric Co. has been announced.

T. A. Boyd, head of fuel dept. research laboratories div. General Motors Corp., has been elected president of the Engineering Society of Detroit.

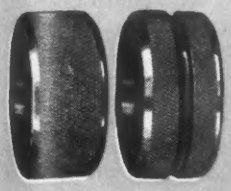
The board of directors, White Motor Co., has announced the election of **Vollmer W. Fries** as a vice-president. Mr. Fries has been on leave of absence from the company for the past year and a half, during which time he served on the WPB in Washington and later as a member of the W. Averell Harriman Mission at the U. S. Embassy in London.

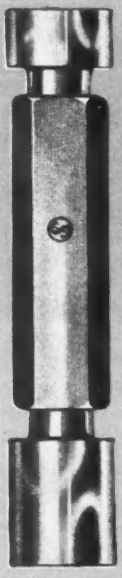
FLYING STEEL
From Atlas in the Army and Navy's greatest bombers softens up the tough spots in Axis resistance and makes the way easier for Allied armies all over the world.
ATLAS DROP FORGE COMPANY
LANSING, MICHIGAN
ATLAS
DROP FORGINGS

How TO ORDER GAGES

When an order for fixed size gages fails to include complete gage specifications, the missing information must be gotten by further correspondence before the order can be put in production. This delays procurement of these vital tools and it also puts an extra burden on the time of procurement personnel. Both can be prevented by including all the following information on gage orders.

LAIN PLUGS and RINGS





Size (Go and Not Go).

Class of gage makers' tolance.

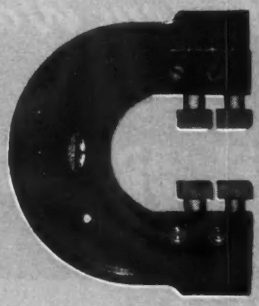
Members desired—Go, Not , Handle.

Length of member—standd or extra long.

If progressive member is nted, so state.

Complete marking instrucns.

SNAP GAGES



1 Frame size.

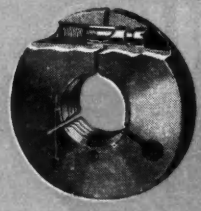
2 Frame model.

3 Range.

4 Stipulate whether gage is to be set and sealed.

5 Complete marking instructions.

THREAD GAGES



1 Size (Go and Not Go).

2 Threads per inch.

3 Class of fit for the work part.

4 Class of gage makers' tolerance and pitch diameter.

5 Members wanted—Go, Not Go, Handle.

6 Complete marking information.

7 Whether or not a setting plug is t accompany a ring gage.

8 If setting plug is ordered, whether rin gage is to be set and sealed.

It is always strongly recommended and good practice to order a setting plug for every thread ring gage purchased because there is no other good way of accurately checking ring gage wear or of resetting the ring gage to compensate for that wear.

The gage maker does not set and seal a thread ring gage unless he also furnishes a setting plug. He cannot do this because of the three variables involved, pitch diameter, lead, and thread angle. Every one of these is interrelated and every one may vary within its own tolerance zone. Thus, a thread plug and a thread ring made at different times or by different manufacturers may both be well within their tolerance limits in every element and still, because of these small cumulative differences, the two might not fit together precisely. When both the ring and the setting plug are made together, these differences can be adjusted, but not otherwise.

SHEFFIELD GAGES MASTER GAGEMAKERS

THE *SHEFFIELD*

CORPORATION

DAYTON, OHIO, U. S. A.

GM Dept. of UAW-CIO Wants Wage Increase

(*Continued from page* 48)

UAW-CIO, voiced the new demands of representatives from 100 GM plants for revisions in the contract when he asked a wage increase of 10 to 11 per cent for 300,000 GM employes unless the cost of living is rolled back by that percentage by Oct. 5. Speaking before the union's GM council at Detroit, to formulate bargaining demands in forthcoming negotiations, Reuther said, "The 'Little Steel' formula for wage increases is no longer sound. I am opposed to inflation and I would prefer the price roll back to the pay raise. But if prices are not reduced to the May, 1942, levels it is imperative that workers have wage increases to meet the cost of living."

On the matter of vacation pay, the UAW-CIO is asking 48 hours' pay after six months employment, 96 hours' pay after three years and 144 hours after five years. The present contract grants 40 hours vacation allowance after one year and 80 hours after five years. GM representatives maintained at the panel hearing that the 1942 rates are consistent with what industry in general is paying for vacation allowances and that any increase would be contrary to the President's hold-the-line order against inflation.

A contract granting a maintenance of membership provision to GM plant protection workers in Lansing, Flint, Saginaw and Pontiac was challenged by the four industry members of the Detroit Regional WLB. In asking the National WLB to review the majority decision, they cited the new War Labor Disputes Act as barring the inclusion of maintenance of membership clauses in contracts approved by WLB. They said Congress had this in mind when it passed the act requiring it to conform with the National Labor Relations Act.

In debate on the Smith-Connally Harness Bill when it was before the House, Representative Marcantonia, N. Y. Democrat and foe of the bill, said, "The NLRB cannot direct a closed shop, union shop or union maintenance clause. . . . I challenge anybody to deny that you are not voting to prohibit the WLB from directing the continuance of a closed shop, union shop or union maintenance agreements."

GM, along with most other automotive companies, has a maintenance of membership clause in its contracts with unions representing production workers. When the Detroit Regional WLB granted the maintenance of membership clause to the GM plant protection workers, Edwin E. Witte, regional chairman, said in a formal opinion, "The clause represents a compromise, during the war, over the issue of the closed shop. This was one of the most important peace-time causes of strikes, and but for the restrictions now imposed upon strikes, there is little doubt that many strikes would be occurring over this issue. The policy adopted by the WLB has eliminated the closed shop as a cause of work stoppages."

Although the Foremen's Association of America lost out in its effort to obtain certification as a bargaining unit at the Detroit Diesel Engine Division of GM, it did make some progress in the dispute with the Ford Motor Co. over discrimination and wage classifications which resulted in the walkouts of June 19-21 and 24. At the request of the National WLB, a 3-man panel of the Detroit Regional WLB was set up to hear the facts in the Ford controversy and report them without recommendation to the Detroit board. Members of the panel are Harry Merrick, Detroit attorney, chairman; R. H. Daisley, general manager of the Eaton Mfg. Co., representing industry, and Stanley Nowak, Michigan state senator, representing labor.

In denying bargaining rights to 19 general foremen and 388 foremen at the Detroit Diesel Engine plant, the NLRB by a 2-1 decision upheld the contention of GM that foremen with certain administrative responsibilities are

(*Turn to page* 150, *please*)

TRU-THREAD DIAMOND DRESSING TOOL STEPS UP THREAD GRINDING PRODUCTION

Examine this new TRU-THREAD diamond dressing tool by Wheel Trueing Tool Company, Inc. You'll see the latest development of an organization that has spent 33 years designing. developing and building diamond tools of fine quality.

You'll see a diamond dressing tool that is setting new records of speed and economy—one that can boast production increases as high as 500% and reductions in per piece grinding costs 75%.

How is this possible? Wheel Trueing engineers have found a way of utilizing the hard characteristics of the natural uncut diamond —never before thought possible in tools of this type. The result is a tool that cuts cleaner —obtains forms faster. Forms hold longer. Fewer dressings are required. More work can be ground between dressings. Down time is reduced. And this tool can be made and reserviced on a production basis, assuring quick deliveries.

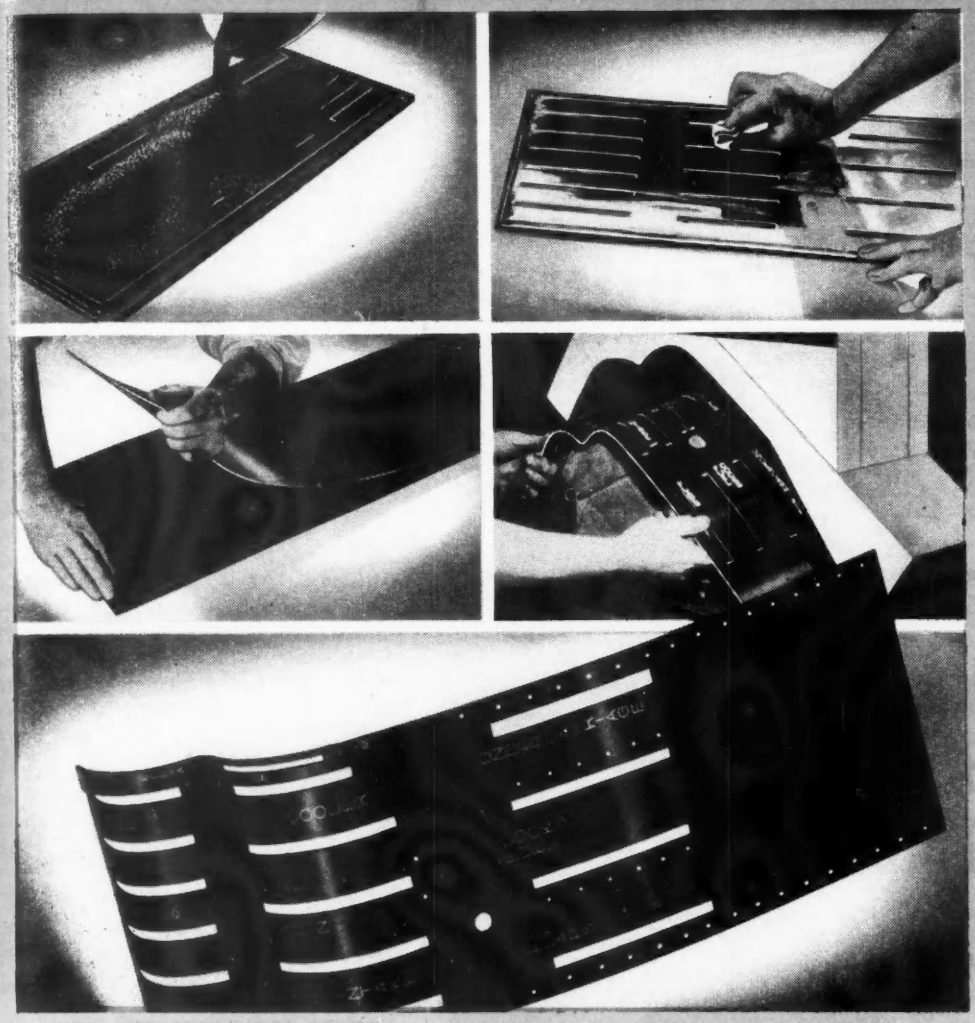
DIAMOND TOOLS for

Straight, form, thread and radius dressing, turning, boring, gaging, and core drilling

You'll learn many other advantages of TRU-THREAD TOOLS once you put them to work on your thread grinding machines. *Write or wire for further information today!*

WHEEL TRUEING TOOL COMPANY INCORPORATED

3200 W. DAVISON DETROIT 6, MICH.



SIMPLIFIED PRODUCTION—The control panel illustrated is typical of the production economies made possible by VINYLITE Plastics. In this instance, the panel is formed, complete in every detail, by a simple molding operation. The technique employed is an adaptation of the plastic printing plate development that makes it possible to conserve substantial quantities of precious metals, and to save even more precious man-hours on the production line.

There are two fundamental steps. First, a matrix of BAKELITE Phenolic Material is made from an etched copper pattern. Second, the phenolic matrix or mold is used to form any number of duplicates from a special VINYLITE Plastic molding compound. Slots, holes, and markings, including intaglio lettering, are incorporated in the panel in this molding operation. A simple pigment "wipe" accentuates the markings and lettering. Then, the flat panel is curved to final shape under heat and pressure on a wooden mandrel. This simple technique eliminates many operations that were formerly necessary with metal plates, such as drilling, engraving, slotting, anodizing, and polishing.

(Panels Molded by Thos. Moss & Co., Inc.)

Vinylite*

TRADE MARK

ELASTIC PLASTICS • RIGID PLASTICS

RESINS FOR ADHESIVES

RESINS FOR SURFACE COATINGS

*The words "Vinylite" and "Vinylseal" are registered trademarks of Carbide and Carbon Chemicals Corporation.

WATERPROOFNESS AND TOUGHNESS for the coverings used on Navy binoculars, which formerly demanded highly cured rubber, are now provided by an embossed sheeting of VINYLITE Elastic Plastics. This plastic covering requires no curing or vulcanizing . . . withstands the corrosive action of salty spray, and prevents penetration of water vapor which would fog the lenses.

"VINYLITE" ELASTIC PLASTICS

Rubber-like materials produced in a variety of forms, ranging from soft to semi-rigid. Possess great toughness and good resistance to continuous flexing, and to severe wear and abrasion. Tensile strength greater than that of most rubber compounds. Have excellent electrical insulating properties, and do not oxidize. Can be made non-flammable and highly resistant to water, oils, and corrosive chemicals by correct choice of plasticizer.

Available in a wide range of translucent or opaque colors, or in colorless types. Supplied as sheeting, compounds, for calendering onto cloth, molding and extrusion compounds, or as powdered resins for industries that have compounding equipment, such as the rubber industry. No curing or vulcanizing is required.

"VINYLITE" RIGID PLASTICS

Produced from unplasticized vinyl resins, these various forms of plastics possess a combination of properties not found in other thermoplastic materials. Having extremely low water absorption, they remain dimensionally stable under widely varying atmospheric conditions. Outstanding in resistance to alcohols, oils, and corrosive chemicals. Have high impact and tensile strengths. Odorless, tasteless, and nontoxic. Do not support combustion.

Available in natural transparent, as well as transparent, translucent, and opaque colors. Supplied as rigid sheets, or as molding and extrusion compounds. Rigid sheet can be fabricated by forming, drawing, blowing, spinning, or swaging, and can be punched, sheared, sawed, or machined with metalworking tools. Molding compounds adaptable to both compression- and injection-molding processes.

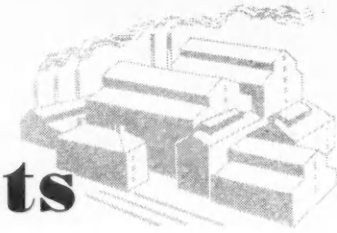
"VINYLITE" RESINS FOR SURFACE COATINGS

When correctly formulated and applied, these resins yield finishes of unusual toughness, gloss, adhesion, and chemical resistance. Can be applied by spraying, knife-coating, or dipping to a wide variety of surfaces, such as metal, cloth, paper, and concrete. Prepared by dissolving resins in organic solvents, these finishes can be modified with different pigments, dyes, and plasticizers. The resins are generally not employed with other film-forming bases, thus coatings formulated from them exhibit the desirable features of VINYLITE Resins alone. Drying is solely by solvent evaporation. Finishes can be either air-drying or baking types.

"VINYLITE" RESINS FOR ADHESIVES

Unusual toughness, resiliency, and impact resistance are characteristic of adhesives made from these resins. They are widely used as bonding agents for such materials as cellophane, cloth, paper, cardboard, porcelain, metal, mica, stone, leather, wood, and plastic sheets and film. Available as granules for the compounding of adhesives, or as solutions sold under the trade-mark "VINYLSEAL." The latter are especially recommended for bonding impervious materials, such as metals, and the urea and phenolic plastics. Their bonding strength is comparable to that obtained with soft solder.

New Products



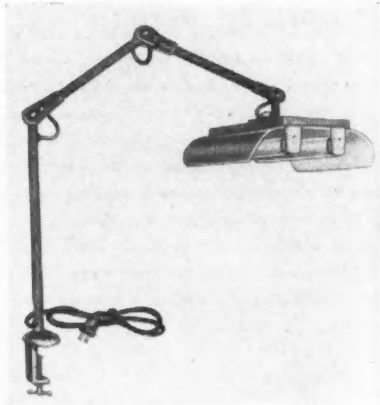
New Bonding Process

A new method of bonding natural or synthetic rubber to metal, or plastics to metal, was recently announced by The U. S. Stoneware Company, Akron, Ohio. The new method, known as The Reanite Bonding Process, is said to develop a bond between rubber and metal ranging from 900 psi to as high as 1200 psi on a pull test. The process is simple in application. The surfaces to be joined are brushed, sprayed, or dipped with Reanite. After being permitted to dry for an hour, the surfaces are joined and the unit vulcanized by any of the conventional methods.

The Reanite Bonding Process may also be used to bond metal to metal, or leather or wood to metal or to each other. The bond between metal and metal ranges from 1000 psi to 3000 psi on a combined shear-pull test. The manufacturer claims that on bonds formed between synthetic rubber and metal, plastics and metal, or wood and metal, the materials give way before the bond.

Flexible Arm Lighting Unit

The Fostoria Pressed Steel Corporation, Fostoria, Ohio, has designed a flexible arm lighting unit to provide the proper quantity and quality of fluorescent light for certain operations.



Fostoria Lighting Unit

The reflector head of this model, which is called the FLB, weighs only 3 lbs. The housing is 22 gage steel, and the reflector, which is made of non-metallic material, is 15 1/16 in. long, 9 in. wide, and 5⅝ in. high. The unit accommodates two 14-watt fluorescent lamps. It is equipped with lamp ballast, and comes completely wired with switch mounted on top of the housing. In excess of 100 foot-candles is provided for the critical work area by this model.

Flux for High Chromium Alloys

Solar Flux No. 16GH, a product of Solar Aircraft Company, San Diego, Cal., was developed for the specialized

(*Turn to page* 154, *please*)

Civilian Advisors Keep Army's Wheels Turning

(*Continued from page* 18)

mercial truck fleets and bus lines of the country. Experienced fleet maintenance men from bus operating companies, public utilities, and common carriers joined with fleet service representatives from the automobile and truck manufacturing companies to provide the backbone of the civilian advisors' program.

Helping recruit the necessary personnel were 400 of the leading transportation and maintenance executives of the country. They have assisted in interviewing, classifying and recommending applicants for posts as civilian automotive advisors. Many have given leaves of absence to men from their own fleets in order that they may place their know-how and long experience in motor vehicle maintenance at the disposal of the U. S. Army.

A typical infantry division has a head automotive advisor who works with the division ordnance officer as assistant on automotive maintenance problems. The head advisor must be well grounded in heavy duty automotive maintenance. He is assisted by 11 other advisors. Ten of these are assigned to regiments or other component units of the division as instructors or assistants to the officer in charge of automotive maintenance. They must have at least seven years' experience in automotive, machinery or metal fabricating industry or can substitute up to four years of college education as equivalent. The twelfth divisional advisor is a parts specialist who understands setting up a parts stock and the general problems involved in parts procurement and distribution.

These maintenance instructors are appointed under civil service rather than commissioned as officers in order to expedite their appointment and make their assignments to various posts more flexible. A civilian advisor stays with a Ground Forces unit for not more than one year, after which he is transferred to some newly activated unit. As officers they would have to accompany the unit to which they were originally assigned. The civilian advisors enjoy officer status, however, and they eat and are quartered with the officers. All must be over 35 years of age. Their average age is 44 and the oldest of the group is 58. Salaries range from $5600 annually for a chief automotive advisor to $2300 for an instructor in parts supply and distribution.

Schools are conducted for civilian automotive advisors at the Ordnance Dept. Motor Transport depots at Camp Holabird, Md., Atlanta, Ga., Normoyle in Fort Worth, Tex., Fort Crook, Neb., and Santa Anita, Cal. During the six-day course the advisors are given detailed instruction on military organizations and functions, military courtesy, echelons of maintenance and supply, motor pool operation, convoy operations, ordnance parts procedure, blackout lights, tank maintenance, and radio interference suppression. They also are given refresher courses in fuels and lubricants, engine tune-up, trouble shooting, live front axles and transfer cases, air and electric brakes, and tires.

Former fleet superintendents serve as technical advisors to ordnance automotive officers and formulate policies for fleets up to 75,000 vehicles. Fleet maintenance managers or factory service engineers oversee the organization and operation of subordinate shops and help diagnose maintenance troubles. Shop service managers or foremen train assistants to regimental operating officers and serve as trouble shooters in the field. Mechanics with practical experience in special phases of maintenance, such as transmissions, differentials, ignition systems or brake assemblies, are assigned to regimental instruction work in their specialties.

Do YOU See
What HE Sees?
IN
SARAN*..
...The Answer
to Scores of Tubing Needs!
To a man familiar with SARAN Thermoplastic Tubing, it's more than just another "war baby." Here is a product that stands on its own feet—possessing qualities that make it a preferred material for scores of applications. It's flexible, easily installed, resists acids and chemicals, withstands high pressures and temperatures to 170° F., and has great tensile strength. With this combination of characteristics, chances are you can find immediate use for SARAN in your operations. Let an experienced Acadia engineer suggest ways in which this versatile product can help you now—and in the post-war period.
Acadia Synthetic Products Division
WESTERN FELT WORKS
Chicago, Illinois: 4035-4117 Ogden Avenue
Detroit, Michigan: 420 Stephenson Bldg.
Branch Offices in All Principal Cities
Largest Independent Manufacturers and Cutters of Wool, Hair and Jute Felts.
*Licensee of The Dow Chemical Company
ACADIA Synthetic PRODUCTS
Processors
of Synthetic Rubber and Plastics
Sheets • Extrusions • Molded Parts

Practical parts men, experienced in preparing instructions, catalog use and parts shipments, conduct classes and serve as advisors on the parts phase of the military vehicle maintenance program.

The civilian automotive advisors have been warned that the soldiers to whom they are teaching maintenance techniques will be on their own once they leave the U. S. and enter a zone of combat. Then they will have no advisors upon whom to lean if something goes wrong with a 4x4 truck or a jeep. The instructors have been told to refrain from doing any maintenance work themselves unless it is for the purpose of demonstration or illustration. Thorough training of officers and enlisted men in the correct maintenance and repair of their equipment under Army-approved standards is expected to develop self-reliance and assure the continued performance of vehicles in the field.

That the work of the civilian automotive advisors is highly valued by the Army is indicated by a letter from Lieut.-Gen. Leslie J. McNair, commanding general of the Army Ground Forces. Gen. McNair writes:

"The automotive technicians are a new element in our training activities, and have made marvelous headway in a surprisingly short time. All commanders are enthusiastic in their praises of these unusual men. Their effect on maintenance has been startling. My only concern is that units will lean on them too heavily and not develop officers and enlisted personnel capable of taking over, when the technicians pass on to other units."

The urgent necessity of preventive maintenance in war-time is aptly stated in the outline of duties and activities of automotive advisors prepared by the Ordnance Dept. As the final point it states:

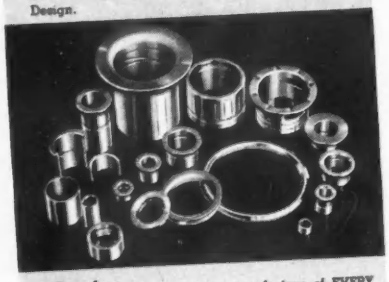
"Importance of motor transportation in the conduct of this war cannot be overemphasized. Therefore, the perfection of maintenance training is of the utmost importance. To paraphrase an adage—'For want of proper maintenance, a motor was lost: for want of a motor, a vehicle was lost; for want of a vehicle a battle was lost.'

"Remember a deadlined tank, armored car or truck is a handicap and serves no useful purpose, captures or kills no enemy. The only Army vehicle worthwhile is one that is rolling and trouble-free. To keep Army vehicles rolling means careful, keen, conscientious preventive maintenance, and constant attention to maintenance problems. Take your position most seriously, ever remembering that human lives, the fate of nations and freedom of all men may depend upon the way you do your job."

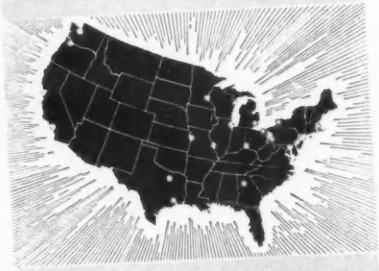
To the MANUFACTURER with VISION for TOMORROW

Technical information regarding all types of SLEEVE BEARINGS such as Alloys, Lubrication, Design.

Research to determine the CORRECT answer to unusual bearing applications.



Facilities for complete manufacture of EVERY type of SLEEVE BEARING and BUSHING.



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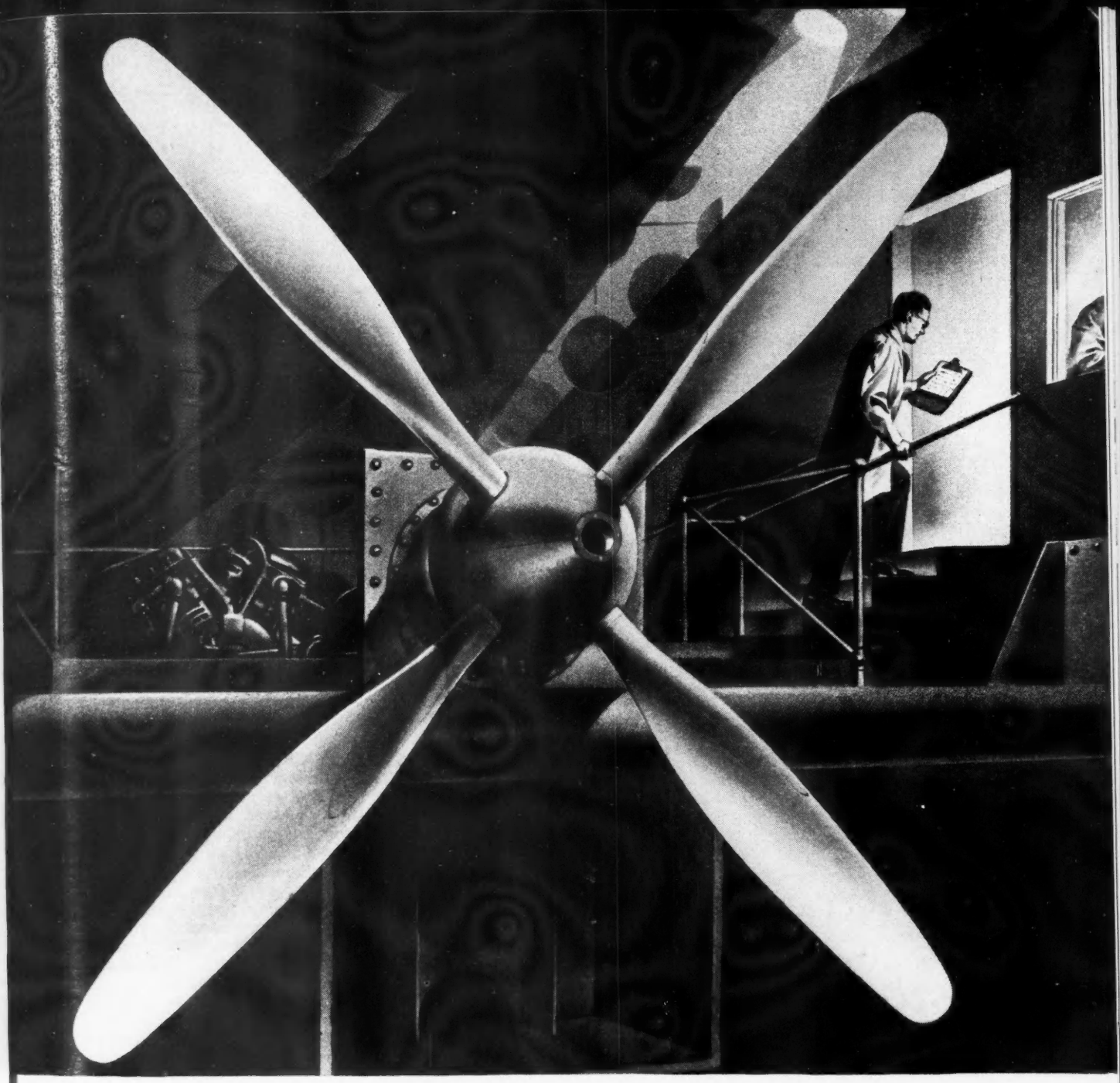
Knotty Problems in Post-War Market

(*Continued from page* 31)

ment after the war. Likewise, any setting of quotas by the industry would be an illegal restraint of trade. With a limited supply and a huge demand for cars, Scoville would accomplish this through the economics of price. To forestall too great a buying boom, he would raise the price of cars by 20 or 25 per cent, selling a former $1,000 car for $1,200. This would tend to reduce the number of potential purchasers. Although the manufacturers and dealers would make larger profits, the Government would take most of them away with greater taxes to help pay for the war.

Another method of reducing postwar automobile demand is for the Government to impose such high personal taxes that a considerable section of the public would not have enough funds to buy motor cars and meet taxes and living costs, too. This method has the advantage, according to Scoville, of reducing the inflationary tendencies inherent in war bond purchases and other savings that are building up personal postwar buying power. Still another means of spreading the postwar demand for automobiles is through im-



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SIMPLIFIED—Aeroprops are built as a self-contained unit. Automatic pitch control and power mechanism for pitch changes are integral parts of the compact propeller assembly.

IN a matter of seconds these four broad blades will be a whirling blur of steel. For hours this production propeller will roar through paces that are tougher than actual combat conditions. Engineers will watch it constantly. A battery of instruments will measure and record every performance factor throughout the run.

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Graduates of this test house are chalking up performance records daily on the fighting fronts. Their strength—their lightness—their rapidity and precision of pitch control—their compact unit-construction, simplifying installation and shortening service operations—these are Aeroprop principles that pay off in successful missions, both in war and peace.

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position of a large Federal excise tax which would raise prices and discourage some purchasers. A factor that also would tend to reduce demand is the tightening of installment credit terms, requiring larger down payments and shorter terms. All these methods have the merit of discouraging postwar inflation, says Scoville, and thus promoting a more stable national economy.

If the postwar demand for automobiles is not curtailed by price increases or other means, Scoville asserts that manufacturers will have to allocate cars to dealers and dealers likewise will have to allocate cars to consumers. This does not always make for the fairest distribution of the product because favoritism enters into it. Manufacturers may allocate cars on the basis of past sales records, but the dealer's allocation to buyers is on a more personal basis because he is closer to his customers. This presents him with a real problem. Also, if the manufacturers do not raise their prices, the dealers likely will do so through trade-in allowances, or other means, in order to take advantage of the sellers' market that will prevail.

Scoville believes the Government has a broad responsibility for regulation of the national economy, but such regulation should be general in scope rather than specific. Rationing, price ceilings, subsidies and material control all may be necessary emergency measures during wartime, but these should be dropped and free competition allowed to prevail as soon after the war as possible. The Government should set broad policies, such as the system of taxation, regulation of credit expansion and other kindred subjects because it is the Government's responsibility to avoid as much as possible any postwar economic difficulties for the nation. But it should not set prices, limit production or ration durable goods when the wartime emergency ends.

The Government's relationship to industry in the postwar period can be compared to that of a parent whose son is going away to college for the first time. The parent can advise the boy to remember to be a gentleman at all times. Or the parent can draw up a list of specific rules to be in bed by 11 p.m. every night, don't smoke or drink, don't gamble, don't cheat in class, etc. The former policy is likely to be more productive of results than a long list of "dos and don'ts."

Reconversion of the automotive plants and resumption of automobile production is one of the knottiest postwar problems that must be worked out, Scoville admits. The possibility that such production might be resumed before the war is over only adds complications. Donald M. Nelson, chairman of the War Production Board, recently told a House Appropriations subcommittee, "When we have licked Germany, it is entirely possible that we ought to be rearranging the war facilities so that we can lick Japan and

(*Turn to page 87, please*)

(*Continued from page* 84)

at the same time arranging to have that (automotive) industry get back into the production of essential automobiles to keep our economy going full speed."

If the industry thus resumes production of passenger cars and trucks for essential civilian use on a partial basis, decision will have to be made as to what plants will produce them. Some manufacturers making engines for military trucks, combat vehicles, tanks and marine use have their automobile engine production and assembly lines intact. Others have completely disrupted engine-making facilities to produce aircraft engines, tank transmissions and other war items. The manufacturer with his engine line available obviously is in a better position to resume automobile production. This would give some companies undue advantage over others.

However, before he can resume civilian automobile production, a manufacturer must clear all Government-owned machinery and equipment from his plant, and arrange with the Government for disposal of raw materials and semi-finished work in process. The Government's cooperation in this disposition is essential if civilian output is to be resumed with any speed. Financial settlement as well as physical removal of these Government assets must be arranged. Scoville believes that an ideal solution of the problem would be for the Government to so arrange the scheduling of war production that war contracts will taper off and civilian production will get under way to take up the slack in labor and help fill some of the great need for durable consumer goods. However, in view of the uncertainties and fluidity of warfare, such close scheduling may be very difficult to achieve. Past history in this war has shown that sudden contract cancellations and necessary design changes dictated by battlefield experience have caused much revamping of schedules with attendant labor and material problems.

Postwar reconversion holds many headaches for the manufacturer, but the Government can ease them considerably by a sane approach to the problem.

Cleveland Auto. Mch. Co. Acquires G & N Mfg. Co.

New Offering of High Pressure Die Casters

The Cleveland Automatic Machine Company has added a line of high-pressure, hydraulic die-casting machines, with the purchase of the G & N Manufacturing Company, also of Cleveland. The "take-over" has been so worked out that both manufacture and sales of the die-casters will be switched to the Camco plant at 2269 Ashland Road, Cleveland, without interruption of production or deliveries.

Assembly Line Methods Used at Douglas Plant

(*Continued from page* 36)

Test stands for important engine units enable workers to insure correct operation before installation. One stand checks fuel pumps and measures the flow at varying speeds. Another serves to inspect vacuum pumps by gaging the amount of suction and the rise in temperature. Still another stand checks hydraulic pumps at pressures up to 1000 psi and measures the flow of oil at this pressure. Another device gives every carburetor a thorough test before it is attached to the engine. Thus the engine preparation department has every facility to guarantee against engine failure, and at the same time does its work with the greatest possible ease.

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BRAKE DRUMS

73,132 Planes Delivered to Army

(*Continued from page* 48)

the first one came off the assembly line in April, 1941. Improvements still are being made to meet changing battle conditions. One of these is the casting of the final drive housing assembly in one piece rather than making it in three sections as formerly.

Although the rate of increase in war production nationally has tapered off in recent months according to reports by WPB and the Army, the automotive industry continues to show gains in the face of contract cancellations, schedule cutbacks and contract renegotiation that cuts down dollar volume of deliveries. June war shipments by the industry totaled $725,000,000 as estimated by the Automotive Council for War Production, a 3 per cent advance over the revised May total of $705,600,000.

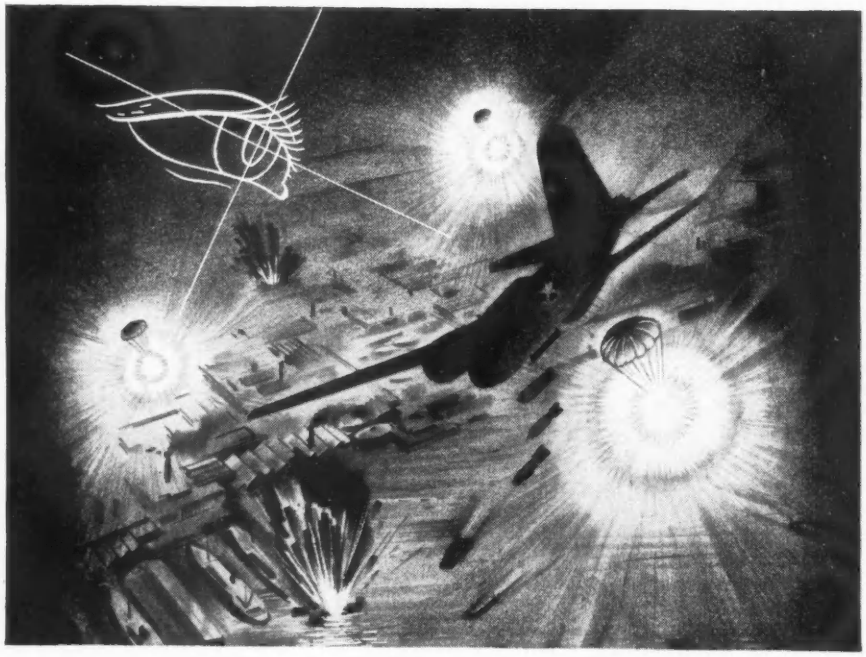
In his monthly report on munitions production, Donald M. Nelson, chairman of WPB, said June output was 2 per cent ahead of May. The latter month had shown no production gain over April. Robert P. Patterson, undersecretary of war, stated that production for the Army ground supply program in June increased 1.1 per cent over May but still was 2.9 per cent below April and 4.9 per cent below June forecasts. Lieut.-Gen. Brehon Somervell, chief of the Army Service Forces, told a Chicago luncheon that June war output totaled only $5½ billion, 9 per cent below the month's goal of $6½ billion. Gen. Somervell said that 1944 schedules called for production of 24 per cent more war material than this year.

Reporting on production for the first half of 1943, Nelson said, "At the end of June 43 per cent of the total volume of munitions requirements currently scheduled for 1943 had actually been produced. In view of the large month-by-month rise in scheduled requirements during the next six months, if we are to meet our goals, the average monthly output must be 30 per cent higher than the average output during the preceding six months."

Nelson said most ammunition components are in abundant supply and schedules have been cut back to absorb excess inventories over a full year's period. Armored car deliveries can quickly be stepped up on a large scale after certain design problems are resolved. Steps also are being taken to increase production of trucks and other lagging motor transport. Total ground ordnance production in June increased 3 per cent over May, combat vehicle output increased 2 per cent, self-propelled artillery decreased 13 per cent, artillery declined 7 per cent and small arms and infantry weapons advanced 14 per cent. June machine tool shipments totaled $108,689,000, a 5 per cent drop from May, while the backlog of unfilled orders declined to $511,478,000; 4.7 months' production at the June rate.

June aircraft production, while over 7000, increased only slightly over May and was up only 3 per cent on a weight basis compared to 10 per cent advances in each of the four preceding months. Causes of the slackened June rate were due to design changes, faulty performance of certain parts and labor shortages in some plants. Patterson reported that combat planes comprised 70 per cent of the June total. Average weight of planes produced in June was 7300 pounds compared to 7100 pounds in May and 6100 in January. The Army Air Force announced on its 36th anniversary that 73,132 planes have been delivered to the Army in the approximately 19 months between Pearl Harbor and July 1, 1943.

General Motors deliveries of war materials totaled $832,275,349 in the second quarter of 1943, an 8.7 per cent increase over the first quarter. An even greater increase in physical volume would be shown if account were taken of voluntary price reductions of $80,000,000 made during the period. War shipments by GM for the first half of 1943 totaled $1,597,801,184, a 15.4 per cent gain over the first half of 1942 and comprising 94 per cent of all GM sales for the period.



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Somewhere tonight over the world's battle fronts American and Allied bombers will cast dark shadows of doom over the military and production installations of our enemies.

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ON THE HOME FRONT we fight the war, too . . . by helping other war plants increase their production . . . by furnishing *quality-controlled* finishing materials and methods which help most industries contribute more to the war effort. If increased finishing efficiency can help YOUR war effort, we suggest you get in touch with us today. Our advisory facilities are at your service.

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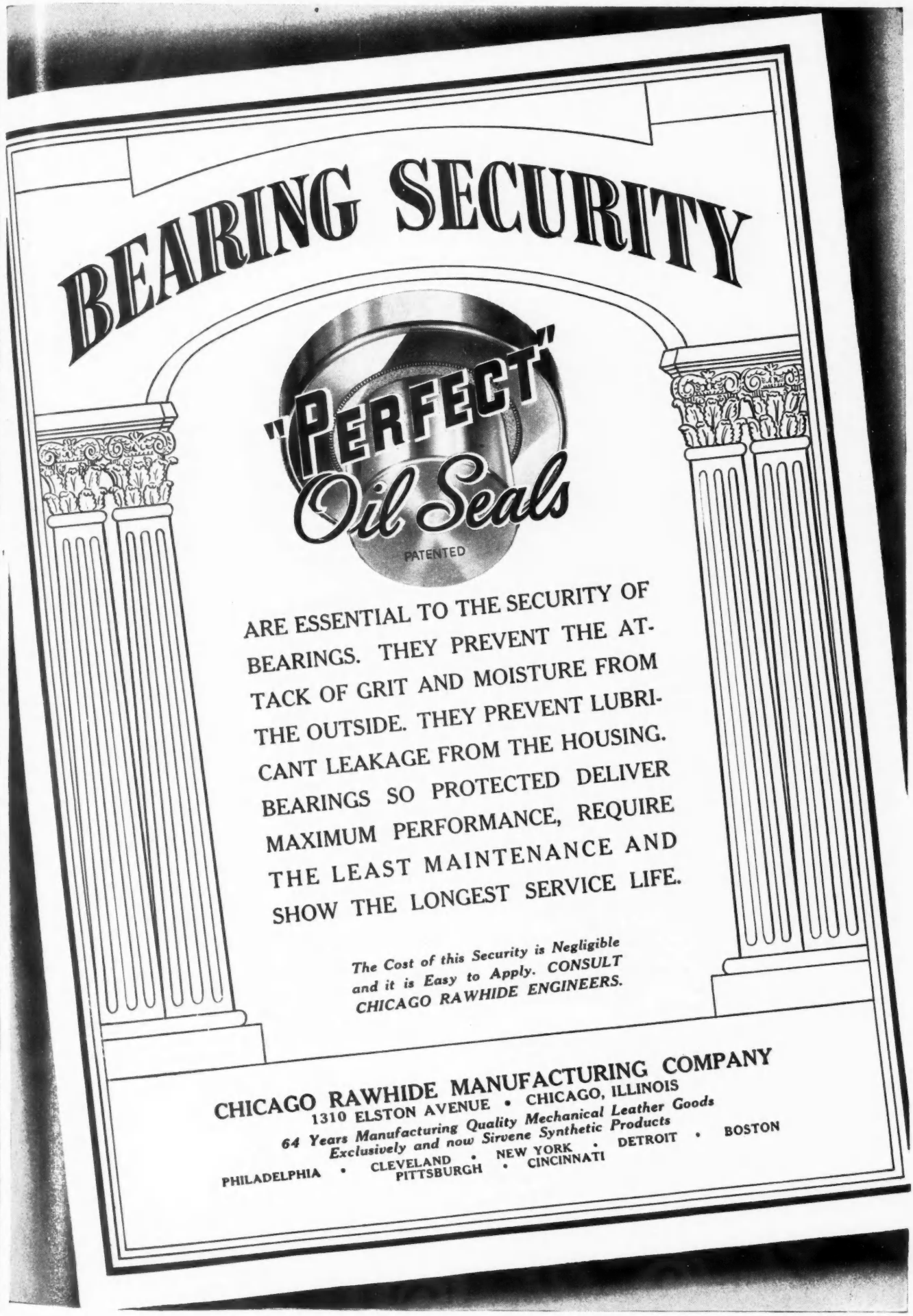
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Curtiss-Wright Well Organized For Warplane Production

(*Continued from page 23*)

be completely mechanized sometime shortly after the publication of this article. The fuselage for Pursuits is fabricated in Plant 1, but the wing assembly and other smaller sections are produced here.

The larger area of Plant 2 is devoted to the assembly of the C-46 cargo transport, these assembly operations being carried out in progressive stages starting with major sub-assemblies. Final assembly is handled on huge dollies which are moved along on rails. Latest addition to plant facilities is an enormous DeVilbiss spray booth built along the line of travel of the assembly rails and capable of housing the C-46 fuselage for its final camouflage finish.

Perhaps the major activity in Plant 2 is sheet metal production. This comprises self-contained departments for metal fabrication, the press shop, heat treating, welding department, sheet metal cutting, etc. Among the items of equipment in this plant are huge Clearing hydraulic presses, H-P-M hydraulic presses, a Birdsboro press, Cincinnati shears, Sciaky welders and others. Several unusually long-bed Onsrud spar milling machines are used for the shaping of the huge spars for the C-46 center wing section. Lindberg furnaces are employed exclusively for the heat treatment of the various stampings. A feature of press shop facilities is the large metal stretching press which is used for shaping extrusions as well as skin sections with mild curvature.

Plant 2 also boasts a new and self-contained drop hammer shop fitted with a number of Chambersburg Cecostamp hammers, one of these being perhaps the largest in use in the aircraft industry. This shop is served by its own Kirksite foundry. To make the hammer shop truly self-contained, it has been provided with a battery of Lindberg furnaces, quenching tanks, and refrigerators for the heat treatment of parts produced here.

Plant 2 operates a large machine shop, although the machine shop in Plant 1 overshadows it as to size and range. The machine shop is equipped with familiar items of machinery such as Cincinnati milling machines, Milwaukee mills, Gisholt turret lathes, J & L turret lathes, several makes of automatic screw machines, etc.

The production department is constantly at work on the improvement of manufacturing methods. One activity is the increasing adoption of cemented-carbide tools for metal cutting operations. Another is the improvement in assembly fixtures and techniques in the production of wings, and other air-frame components. An interesting development along this line is the adoption of Morrison metal stitching machines for the attachment of fabric, rubber, or metal strips to metal stampings. This has resulted in a major saving of man-hours and cost, as well as an improvement in the product.

A feature of interest to machine shop operators is the new system evolved for the distribution of lubricant to machine tools and provision for draining and flushing. This central system is provided with a pump for circulating from 100 to 120 gal. of hydraulic turbine oil to a battery of more than 300 machines, maintaining a pressure of 40 to 45 psi. Service oilers simply open a valve to fill the reservoir of the machine to the proper level. In addition, each machine has a hand oiling nozzle connected to the central supply system to take care of lubrication points which must be oiled by hand. It is estimated that about 80 per cent of machine shop lubrication can be handled by a service man armed with a single wrench.

Flushing of machine tools systems now is done with a portable pumping unit connected to a drain barrel. To facilitate this arrangement, standard sized outlets were installed on all machines, leading from drain plugs to easily accessible positions. After draining, flushing oil is pumped in and out by the same means. This operation takes only 12 to 15 min as contrasted with the former

time of about an hour and a half. This time, of course, varies with different types of machines.

Materials handling has been worked out to fit the current manufacturing scheme, relying entirely upon an intricate network of ceiling mounted, sensitively controlled Cleveland Tramrail hoist and crane units. The installation at the present writing comprises the following items of equipment:

IN PLANT 1	IN PLANT 2
18,700 ft. of Cleveland Tramrail No. 2100 rail	24,200 Cleveland Tramrail arch beams
11 hand power cranes	7,350 ft. Cleveland Tramrail No. 2100 rail
34 motor-driven cranes	18 hand-propelled cranes
25 motor-driven carriers	21 motor-driven cranes
2 special cranes	21 motor-driven carriers
7 motor-driven hoists	13 hand propelled electric hoist carriers
	5 special cranes

A supplementary article, to be released in a later issue, will describe the manufacture of some selected sub-assemblies more in detail and with additional factory views.

British Karrier-Humber Armored Car

(*Continued from page* 19)

(approximately 3⅜ by 4¾ in.) and a compression ratio of 6 to 1, developing 90 bhp, with 184 lb-ft maximum torque at 1300 rpm. It is mounted at the rear of the chassis with the radiator behind it and is governed to 3400 rpm by the velocity governor of a Solex carburetor, which is fitted with an A.C. oil bath air cleaner. The four-bearing crankshaft is counterweighted.

The standard full pressure lubrication system, with floating intake and renewable by-pass filters, is supplemented by the provision of an oil cooler with a hand-operated by-pass valve. Water temperature is controlled by thermostat, the housing of which incorporates a pressure loading valve set to blow at 5 psi. Ignition is by screened double contact breaker with full automatic control.

A unit-constructed clutch and four-speed transmission are close-coupled by a Layrub jointed primary propeller shaft to a two-speed transfer box amidships, whence the drive passes through two central propeller shafts with high-angle needle roller joints to full floating front and rear axles with spiral bevel final drive. (The corresponding Daimler vehicle, it may be recalled, has four propeller shafts, one to each wheel.) Front wheel universals are of the Tracta constant velocity type. Steering is by Bishop cam and lever gear.

Suspension is of the conventional half-elliptic type fore and aft, though the springs have trunnion ends and blocks allowing about 15 deg movement in either direction, thus providing relief to the back plates and spring anchorage points. Equipment includes piston-type shock absorbers and 10.5 x 20 in. low-pressure, run flat tires. Four-wheel brakes and Lockheed-Cowdrey hydraulic type with chrome-iron drums of 16 in. diameter and 3 in. wide contact surface. The hand brake linkage is the mechanical type and operates the rear wheel brakes only. Electrical equipment is 12-volt with insulated return except for ignition. It is screened against radio interference.

The hull and turret are of nickel-chrome-molybdenum steel plate and are flexibly mounted on the chassis, with four stabilizers, one at each corner, to prevent excessive relative movement between chassis and hull. A Vickers periscope is mounted on the commander's head-flap, which opens in halves, forward and rearward respectively.

Weighing about 7 long tons complete, the vehicle has a wheelbase of 92 in. with unusually wide track of 76 in. front and 72 in. rear. Minimum ground clearance (under axle centers) is 12 in. With the engine governed to 3400 rpm the maximum speed is 45 mph. The two-ratio transfer box provides ratios ranging from 8.69 to 1 to 8.65 to 1, with an axle ratio of 6.86 to 1. Gradients as steep as 1 in 2 (50 per cent) can be climbed from a standing start. With five cross members, the pressed steel frame has side rails of 3/16 in. stock, 8½ in. deep (max.) and 2 9/16 in. wide.

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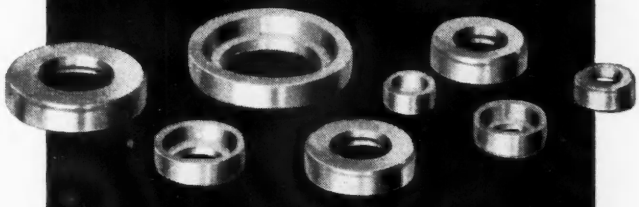

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Ordinarily, these are a screw machine product, but ours are stamped. Thus we are able to provide accurate, uniform washers with prompt delivery and at lower cost. Compare our prices! Made from high quality steel and cadmium plated to Army-Navy Specification AN-QQ-P-421. *Sizes to fit all popular taper pins in stock. Four weeks delivery on sizes not in stock.*

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AERO SCREW COMPANY

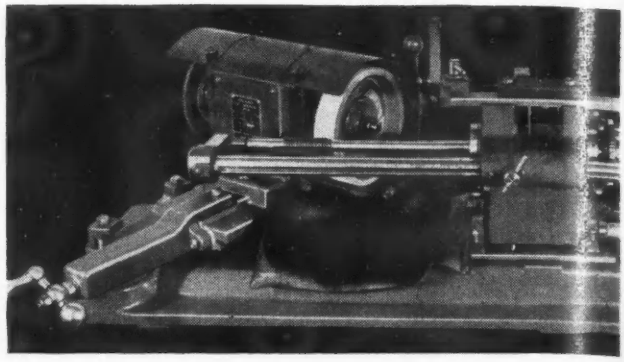
19th Ave. at 12th St., Rockford, Illinois

New Production Equipment

(*Continued from page* 46)

ard sizes of fixed gap turret lathes, three standard sizes of sliding bed gap turret lathes, and special heavy duty turret lathes to suit special requirements.

The Libby Type H fixed gap turret lathe was designed to handle large or irregular parts. Machines are available with fixed gaps 26 in. to 56 in. long in 6 in. increments. The 3H machines will swing 42 in. diameter; 4H machines swing 45½ in. diameter; and 5H machines swing 49 in. diameter.



No. 2 Blake Tap Grinder

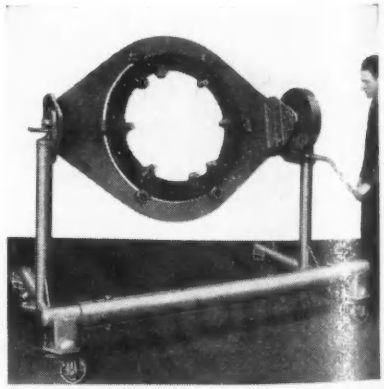
The sliding bed of the Libby Type H sliding bed gap turret lathe may be adjusted to any desired width gap to suit the work at hand, and provides additional swing up to 84 in. The gap may be closed to convert the machine to a conventional turret lathe.

THE No. 2 Blake Tap Grinder for sharpening the chamfer on taps from No. 0 to 2 inches, and up to 14 inches long, is being offered by the Edward Blake Company, Newton Centre, Mass. This grinder is similar in construction to the No. 1 Blake Tap Grinder except that the bed casting is longer to accommodate longer taps. The segment under the wheel head slide is wide enough to allow the head to be swivelled for chamfer angle, either in the conventional manner, or around to the back of the work. This is advantageous when sharpening shell type taps, or taps with long pilots, as the work must clear the wheel head yet be rigidly supported.

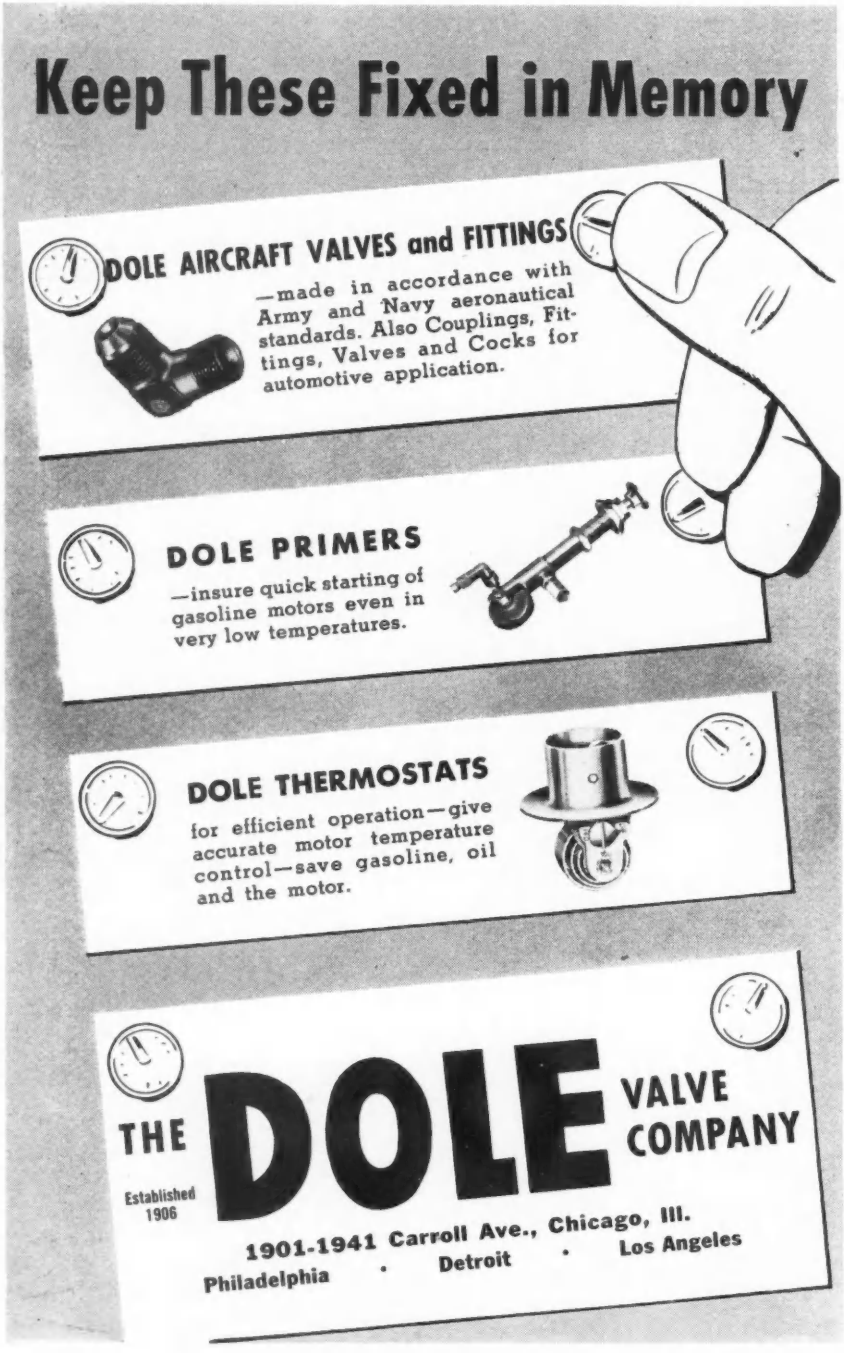
The No. 2 machine is equipped with a longer feed screw for clearing the bed when the wheel head is swung to the extreme rear position.

This machine is provided with change gears for sharpening 2, 3, 4, 5, 6, 8, or 10 flutes, right- or left-hand.

THE Aviation Division of the Whitings Corporation, Harvey, Ill., is now manufacturing a multi-purpose engine, block, and cylinder tear down and



Whiting Model E5 Multi-Purpose Assembly Stand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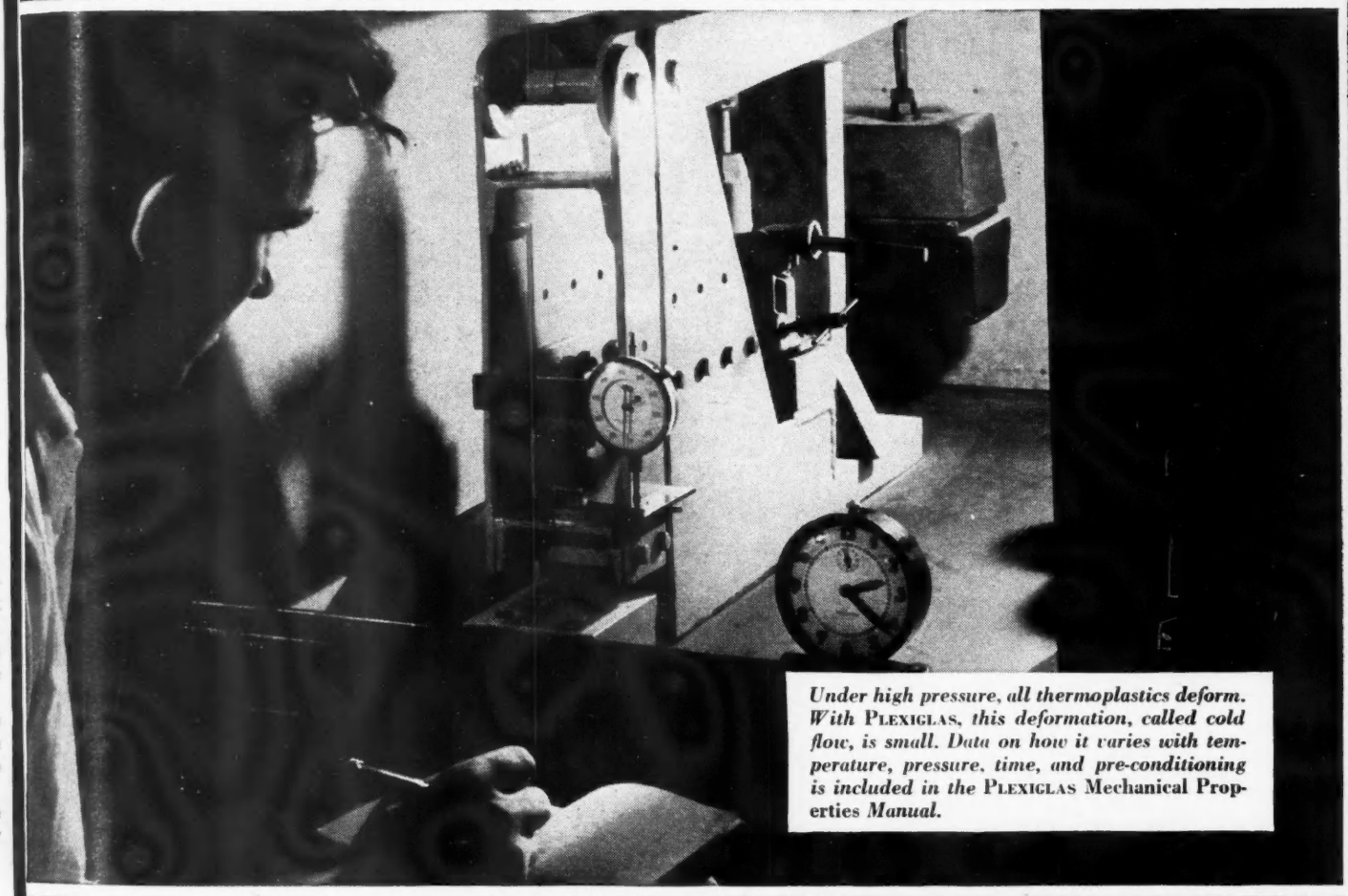

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CRYSTALITE

MOLDING POWDER

PLEXIGLAS and CRYSTALITE are the trade-marks, Reg. U. S. Pat. Off., for the acrylic resin thermoplastics manufactured by Rohm & Haas Company.

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA, PA.

Manufacturers of Chemicals including Plastics . . . Synthetic Insecticides . . . Fungicides . . . Enzymes . . . Chemicals for the Leather, Textile and other Industries

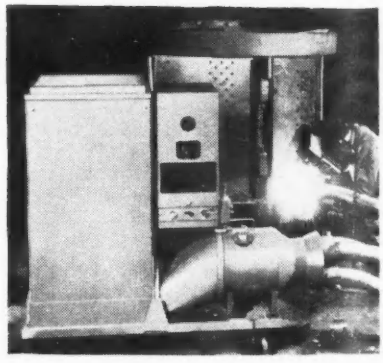
assembly stand. By means of an extension bar and interchangeable rotating bed plates and accessories, the Whiting Model E5 Multi-Purpose Assembly Stand may be used as a radial cylinder assembly stand, a radial engine assembly stand, an in line or "V" block assembly stand, or an in line or "V" engine assembly stand. The compactness and broad range of purpose of the Model E5 permit changing from one type of work to another with minimum loss of time.

DESIGNED to provide accurate and automatic temperature control of coolants and lubricants in machine processing. Frostrode model 75-AC coolant cooler has just been announced by Frostrode Products, Detroit, Mich. The coolant cooler is said to be adaptable to virtually any type of machine and operation involving the use of coolants, and especially desirable for heavy cutting and high pressure grinding operations.

Work distortion due to unequal heating during grinding and other operations is minimized by the use of the "Frostrode" coolant cooler in accurately and automatically controlling coolant temperature. The machine operator selects the coolant temperature by setting a dial on the panel of the cooler. No attention is required by the operator to maintain a continuous flow of coolant at the temperature selected to carry excess heat away from the work as fast as it is generated. Variations in room temperature are automatically compensated for by an integral differential thermostat. Rated capacity of the Model 75-AC cooler is 18 gallons of coolant per minute when cooled down to 20 deg F below room temperature.

Frostrode Model 75-AC Coolant Cooler

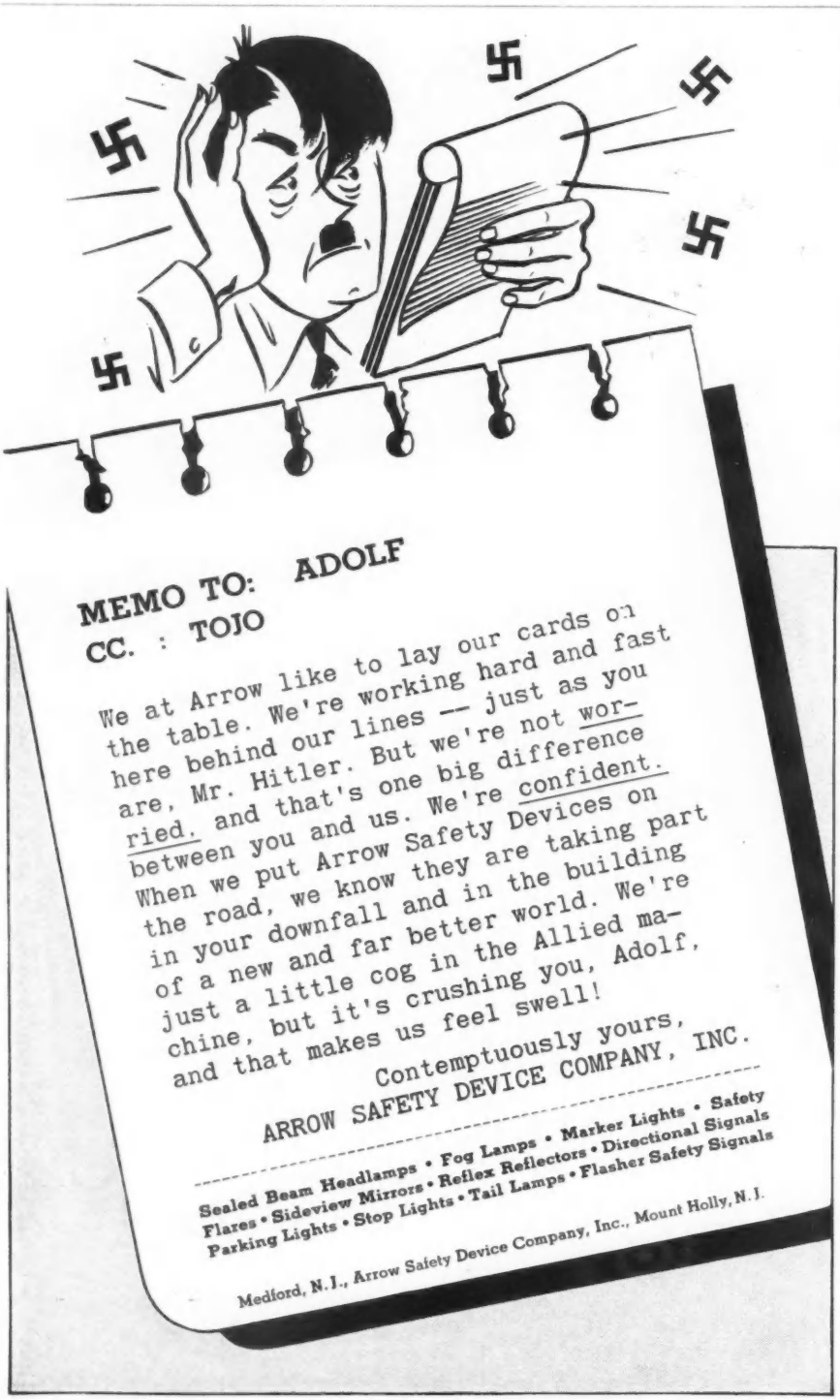
ONE of the latest uses of electronics in industrial functions is for removal of welding fumes directly from the scene of welding activity. This portable Westinghouse Preciptron electrostatic air cleaning unit with three flexible metal hoses can be moved to any plant welding location. Welding fumes drawn through the hoses pass through the air cleaner where 90 per cent of the fumes and air borne particles are removed. The cleaned air is then returned to the room.



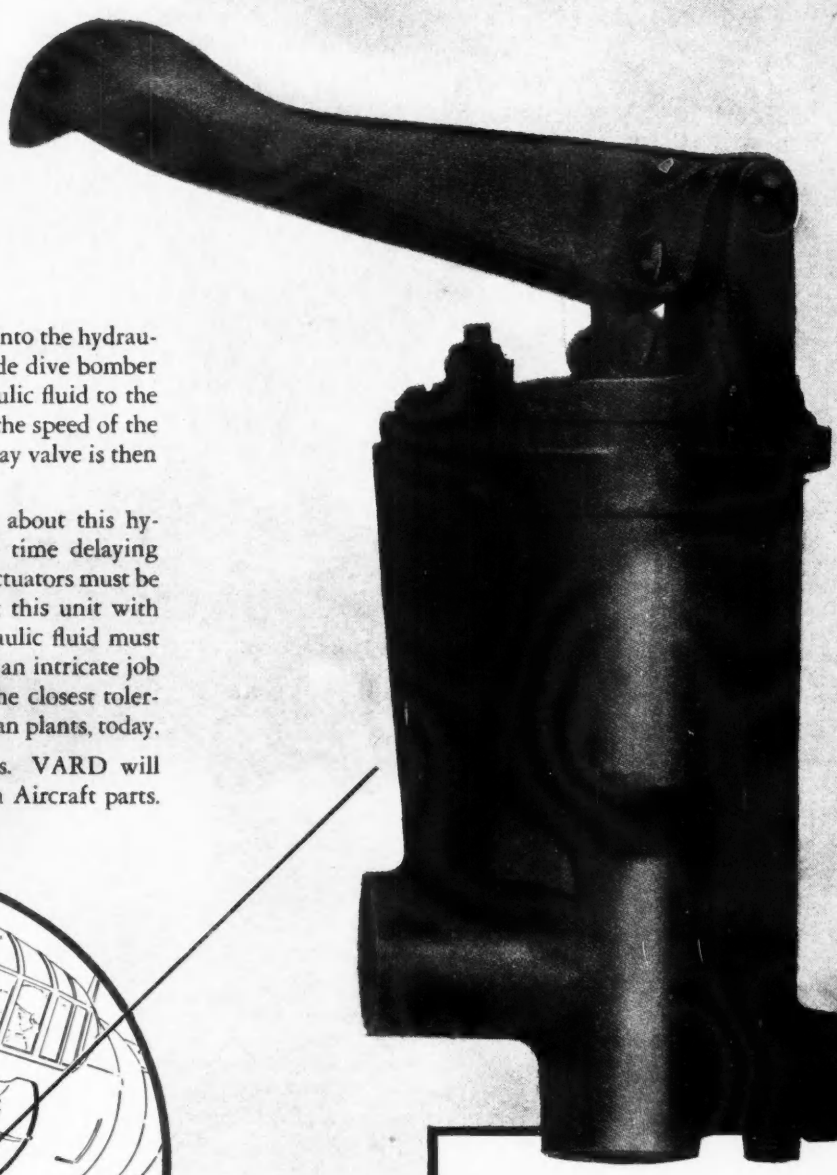
Westinghouse Preciptron

MULTIPLE thread milling cutters, featuring the Higbee cut, are now available from the Plan-O-Mill Corporation, Hazel Park, Mich. These cutters, called "Multi-Millers," are said to make possible the milling of a perfect thread in a single operation. The Higbee cut, which is provided by the Multi-Millers, removes the imperfect thread or "feather-edge" at the same time the thread is milled.

This line of cutters is available in National, Whitworth, Acme, V, and spe-


MEMO TO: ADOLF
CC. : TOJO
We at Arrow like to lay our cards on the table. We're working hard and fast here behind our lines — just as you are, Mr. Hitler. But we're not worried. and that's one big difference between you and us. We're confident. When we put Arrow Safety Devices on the road, we know they are taking part in your downfall and in the building of a new and far better world. We're just a little cog in the Allied machine, but it's crushing you, Adolf, and that makes us feel swell!
Contemptuously yours,
ARROW SAFETY DEVICE COMPANY, INC.
Sealed Beam Headlamps • Fog Lamps • Marker Lights • Safety Flares • Sideview Mirrors • Reflex Reflectors • Directional Signals Parking Lights • Stop Lights • Tail Lamps • Flasher Safety Signals
Medford, N.J., Arrow Safety Device Company, Inc., Mount Holly, N.J.

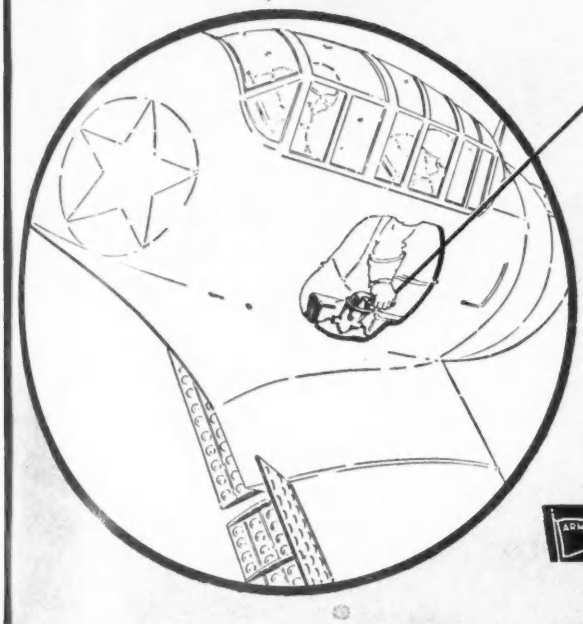
SKY BRAKE



This Time Delay Valve fits into the hydraulic system of an American made dive bomber and controls the flow of hydraulic fluid to the wing flaps. These flaps brake the speed of the plane in descent. The time delay valve is then a brake control.

The distinguishing feature about this hydraulic unit is of course the time delaying element. Ordinary hydraulic actuators must be precision made, certainly, but this unit with measured control of the hydraulic fluid must be precision plus. In fact, it is an intricate job of machining right down to the closest tolerances being worked in American plants, today.

VARD makes these valves. VARD will always be making the finest in Aircraft parts.



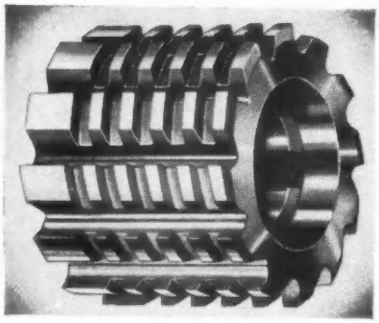
In times of Peace—Prepare for War. In time of War Prepare for Peace! All Americans must realize that war industries with depleted reserves, sinking funds and profits, can never rally to meet the Crash of Cancelled Contracts. We must have reserves to meet the storm—and Win the Peace.

ARMY E NAVY

VARD INC.

Thread & Plug Gages • Snap Gages • Plain Tapered Ring Gages • Bench Model External Comparators • Dividing Machines • Precision Ground Optical Lenses & Filters • High Fidelity Mirrors

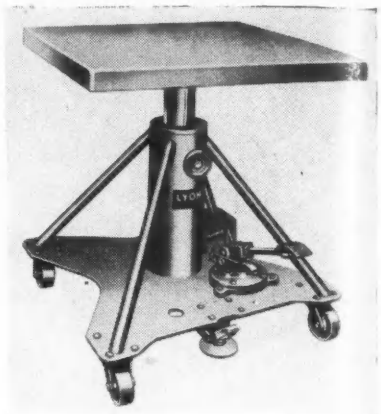
PASADENA, CALIFORNIA, U.S.A.



Multi-Miller made by Plan-O-Mill Corporation

cial forms, with straight or spiral flutes. They are offered ground or unground in a complete range of sizes for use on any type of thread milling machine.

THE Lyon Hydraulic Elevating Table, a product of the Lyon-Raymond Corporation, Greene, N. Y., can now be furnished with seven different optional features. These features are: A floor lock to keep the table from moving on its casters; a spring balanced towing handle; a locking device which allows the table top to be turned and locked at each 15 degrees of rotation; collapsible retaining bars to hold work on table

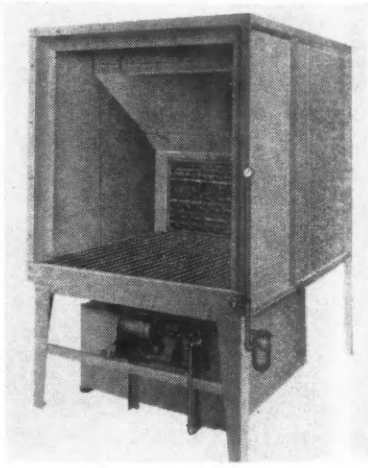


Lyon Hydraulic Elevating Table

top; four swivel casters in place of the two swivel and two stationary casters; stationary feet in place of casters; and a two-speed hydraulic foot pump in place of the single speed foot pump.

The maximum lifting capacity of the standard unit is 2000 lbs. Its 30 in. square table has a lowered height of 29 in. and an elevated height of 43 in.

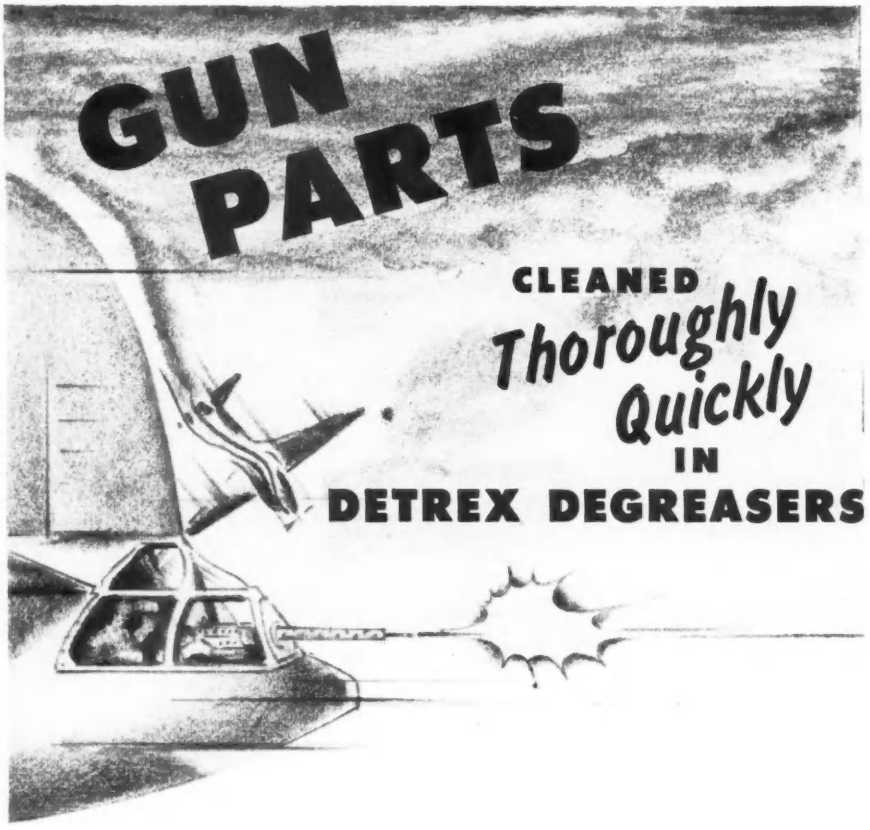
A SPRAY degreasing booth has just been brought out by The DeVilbiss Company, Toledo, Ohio. The manufacturer claims that it holds solvent loss to a minimum. It is engineered for safe



New Spray Degreasing Booth

operation, even when hazardous materials of high volatility and low flash point are used. The booth is made in 14, 16, and 18 gage steel. Sizes vary according to the requirements of the product to be handled.

A COMPLETE line of laboratory furnaces has been developed by the Lindberg Engineering Company, Chicago, Ill. The line includes such types as the Box Furnace for drying precipitates, ash determinations, fusions, and ignitions; the Combustion Tube for carbon determination, standard combustion and organic analyses; the Crucible Furnace for melting base metals, thermo-couple calibrations and molten salt baths; and Hot Plates for heating,



Guns that blast the enemy from the sky, from aircraft and from "ack-ack" batteries . . . guns that pound Axis positions from long range . . . guns used for deadly close-in fighting . . . all are tribute to the efficiency of American production.

Detrex has played an important part in the manufacture of the gun parts so necessary to Allied victory. It is because of the speed and thoroughness of modern metal cleaning processes such as Detrex Degreasing that other production operations can be completed faster and at lower cost.

It is through the use of Detrex equipment and chemicals, too, that millions of other armament parts are being turned out in quantities that continue to exceed all production quotas.

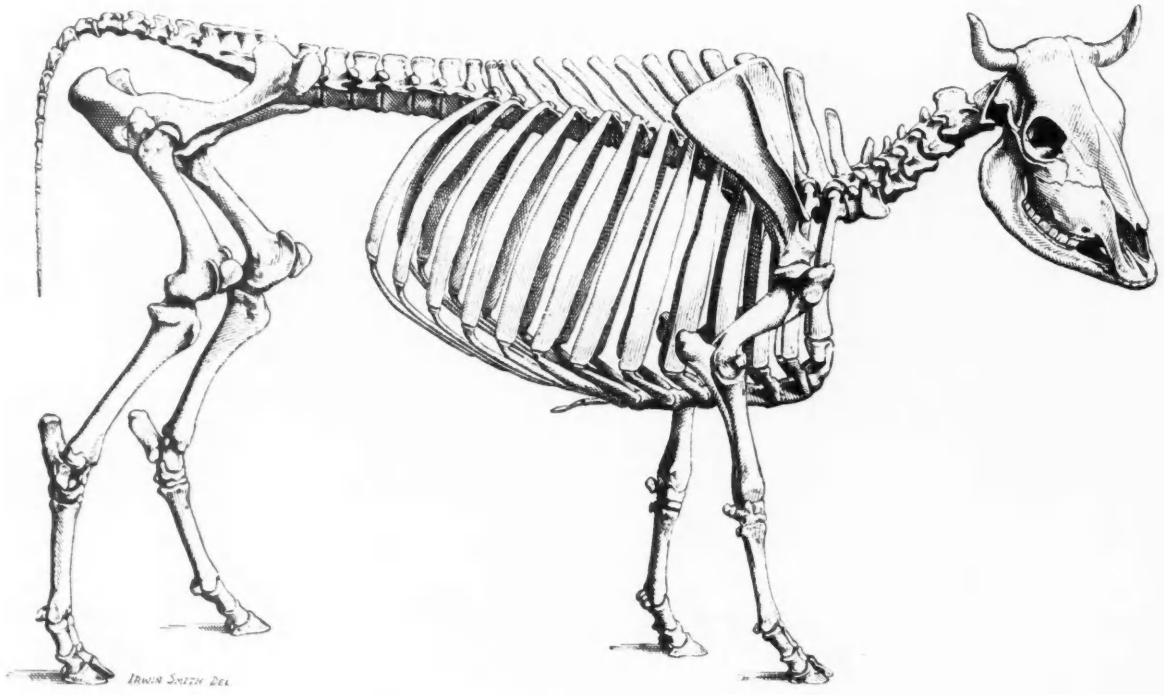
SOLVENT DEGREASING and ALKALI CLEANING

DETROIT REX PRODUCTS COMPANY

13001 HILLVIEW AVENUE • DETROIT, MICHIGAN

Branch Offices In Principal Cities of U. S. A. — In Canada: Canadian Hanson & Van Winkle Co., Ltd., Toronto, Ontario

THE SKELETON OF A GREAT IDEA



Only 47% of a steer is edible meat. The rest is bones, gristle and other inedible materials.

In the past, meat has been brought to market in carcass form. Countless tons of inedible bones and surplus fat have been transported countless miles...by railroad, ships and trucks. An enormous waste of energy and shipping space!

Today, to save precious shipping space, meat is being shipped to our armed forces abroad de-boned and de-fatted. The skeletons of the steers are being left home.

The U-boats made this change necessary. Modern, high-efficiency refrigeration made it possible.

Steaks and other de-boned cuts of meat are now pressed into compact blocks and refrigerated at low temperatures. Dependable refrigeration equipment has been provided by General Electric for this purpose.

To meet unusual war needs, enormous strides have been made in the development of General Electric *industrial refrigeration* and *air conditioning.*

Equipment is more efficient, more compact, more flexible. When the war ends, these improvements will be applied to peacetime uses and made available to all.

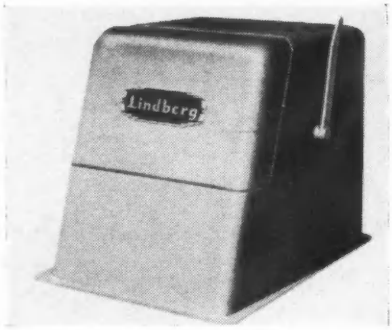
☆ BUY WAR BONDS ☆

General Electric Company, Air Conditioning and Commercial Refrigeration Divisions, Section 438, Bloomfield, New Jersey.

Air Conditioning by

GENERAL ELECTRIC

Listen to the General Electric radio programs: "THE HOUR OF CHARM", Sundays, 10 P.M., EWT, on NBC..."THE WORLD TODAY" News, Weekdays, 6:45 P.M., EWT, on CBS

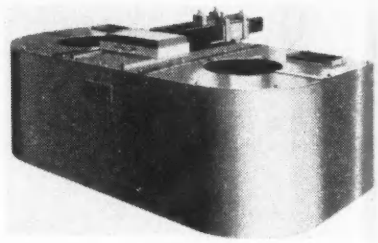


Lindberg Laboratory Furnace

distilling, boiling and evaporating.

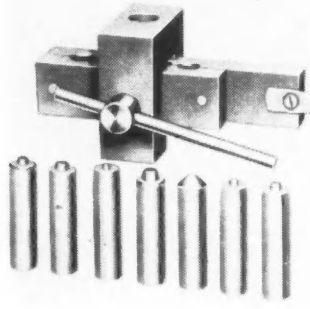
The new furnaces incorporate such features as the door operating mechanism on the box furnace, which permits cooler working conditions; low voltage, high temperature type heating elements; and the use of a Lindberg Input Control for "stepless" apportioning of heat.

THE Type 230 High Speed Heat Treating Unit has been added to the line of heat treating furnaces made by The A. F. Holden Company, New Haven, Conn. The unit consists of three pots, each having a different temperature range to suit various types of work. Pot No. 1 has a temperature range of 1400 deg F to 1800 deg F for preheating high speed tools; for heating water and oil hardening steels or alloy steels such as high carbon-high chrome or stainless types; for carburizing, and for silver soldering. Pot No. 2 has a temperature range of 1900 deg F to 2350 deg F for hardening all types of high speed steels, for copper brazing, and for heating forgings. The temperature range of pot No. 3 is 1000 deg F to 1400 deg F for quenching high speed tools from the hardening temperatures, for tempering, nitriding or blueing, and for descaling forgings and similar parts.



Holden Type 230 High Speed Heat Treating Unit

FLARE-MASTER flaring tools, made by Everhot Products Co., Chicago, Ill., are designed to produce a 45 deg. double lap flare for SAE flare-type and inverted flare-type connections on Bundy, Bundyweld and Bundyflex steel tubing. The tool also produces a double flare on aluminum, copper, Monel metal and similar tubing.

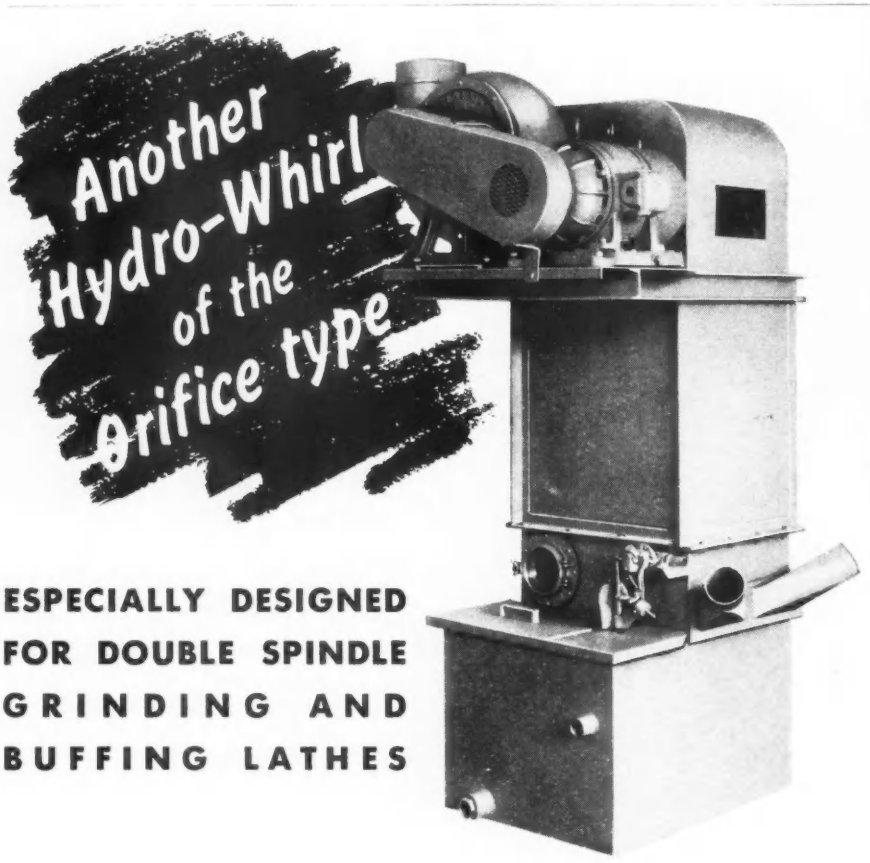


Flare-Master Flaring Tool

Tubes are held with a smooth, firm grip, without serrations or threads. The tool consists of three parts; a pair of holding jaws, a "U" shaped clamp and a built in vise. All wearing parts are of hardened steel.

THE Logan Engineering Company, Chicago, Ill., has just brought out a small quick change gear lathe called the Logan No. 820. The bed is 43⅛ in. long, and the distance between centers is 24 in. Swing over the bed is 10½ in. The quick change gear box provides 48 threads and feeds, either right or left hand. Adjustment of the two levers provides for cutting threads from 8 to 224 per inch. A 48 tooth stud gear is supplied to replace the 24 tooth stud

(*Turn to page* 150, *please*)



ESPECIALLY DESIGNED FOR DOUBLE SPINDLE GRINDING AND BUFFING LATHES

Its cleaning action is produced by the force of air issuing through an orifice. Its only mechanical moving parts being a fan and a motor, this Hydro-Whirl unit meets the country's effort to conserve critical materials.

The water level is controlled by a specially constructed diaphragm valve. Sludge removal compartment is at side.

Pictured here is a unit made for a large magnesium processor. Larger models are available to meet any specific conditions.

The Hydro-Whirl principle of dust collecting is receiving high acclaim for its high efficiency. It is to your advantage to talk to us if you have any dust problems, particularly those involving magnesium processing.

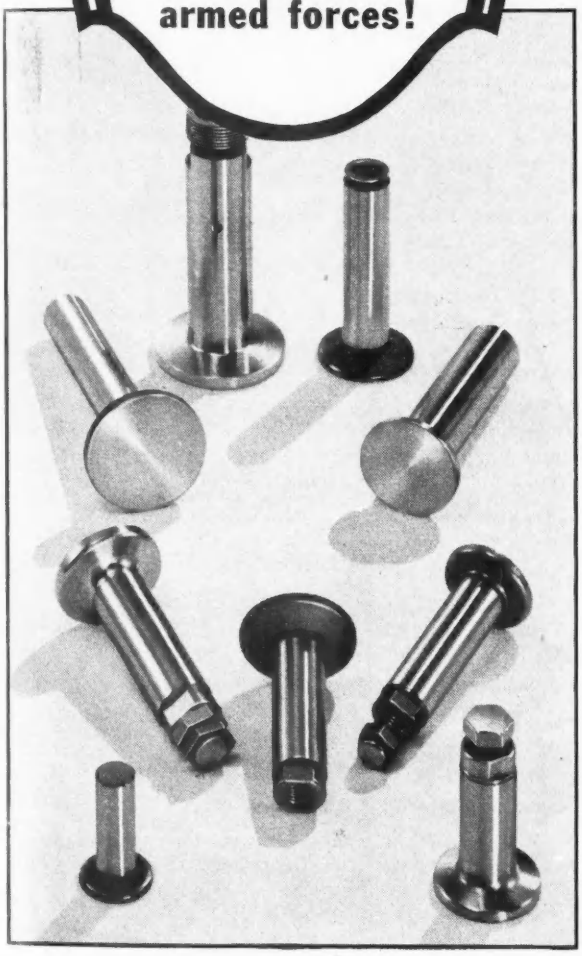
HYDRO-WHIRL

INDUSTRIAL EQUIPMENT CORPORATION

formerly Industrial Sheet Metal Works

634 EAST FOREST AVENUE • • DETROIT, MICHIGAN

THE
CHICAGO SCREW CO.
serves the armed forces!

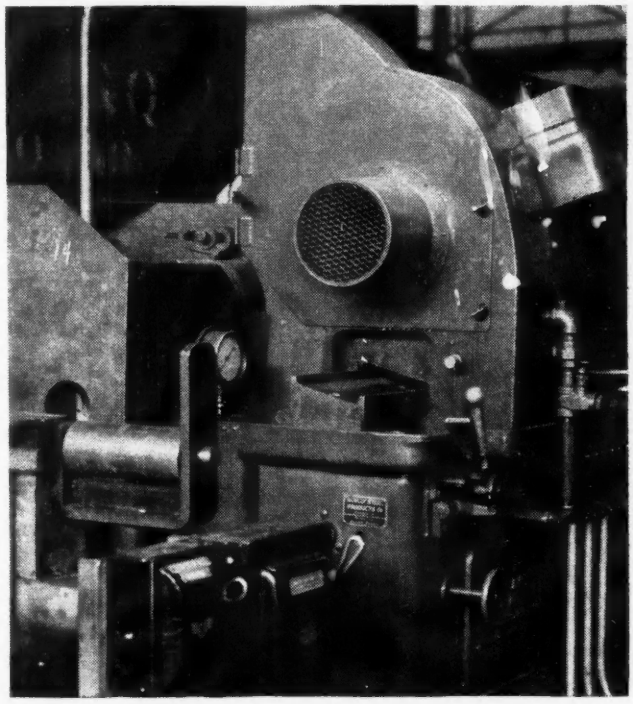


CHICAGO TAPPETS
★ AIRCRAFT QUALITY ★

Chicago Tappets operate under "front line" conditions, free from the necessity of replacement or service! We are specialists in the manufacture of Valve Tappets, Push Rods, Valve Spring Retainers, Connecting Rod Bolts, Ground Thread Studs, all to **Aircraft Quality Standards.**

★

THE CHICAGO SCREW CO.
ESTABLISHED 1872
1026 So. Homan Avenue Chicago, Ill.



Campbell Abrasive Cutting Machines
HELP MAINTAIN SCHEDULES FOR GREAT STEEL MILL

CAMPBELL offers you the same service today that it offered the steel mill—one of whose CAMPBELL ABRASIVE CUTTING MACHINES is shown above.

All you need to do is send CAMPBELL Engineering Department data on your cutting—materials being cut, sizes, shapes, lengths before cutting, lengths of cut-off pieces and production you require per hour.

CAMPBELL engineers will then develop production procedures and costs—without any obligation on your part.

The sound foundation for this service is CAMPBELL's experience and complete range—the only complete range—of Abrasive Cutting Machines.

These machines right now are cutting solid bar, tubular and flat stock—steels of all grades, annealed and unannealed; non-ferrous alloys; plastics; glass and ceramics. They have made it possible for many to meet wartime schedules.

Your letter will receive prompt attention.

Campbell

ABRASIVE CUTTING MACHINES

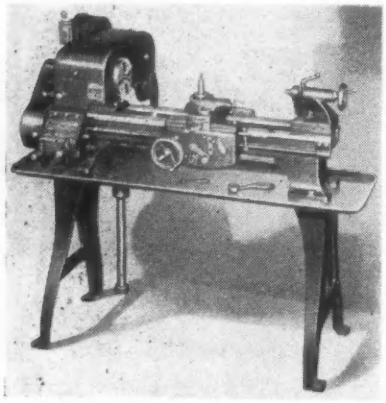
ANDREW C. CAMPBELL DIVISION
BRIDGEPORT • CONNECTICUT

ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

ACCO AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

New Production Equipment

(*Continued from page* 98)



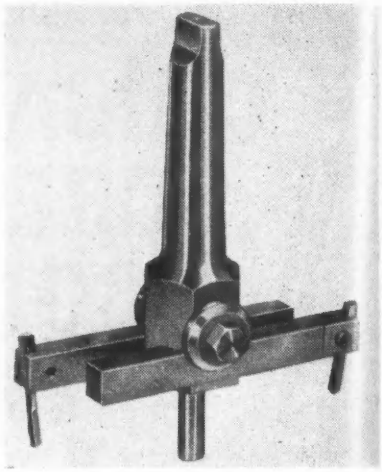
The Logan No. 820 Quick Change Gear Lathe

gear for cutting threads from 4 to 7 per inch. Similarly, longitudinal power feeds from 0.0015 in. to 0.1000 in. per spindle revolution may be obtained. Power cross feeds are .25 times the longitudinal feeds.

PRECISION surface plates of granite are a recent development of The Herman Stone Company, Dayton, Ohio. They are made of extremely hard natural granite, and do not rust, corrode, or warp. The working surface is processed while the unit is supported at three points. These bearings remain on the plate permanently so the plate can be used on the same supports on which it was finished. The maker claims that the plates are accurate to 1/10,000 in. and have a 100 per cent bearing surface.

SUPPLEMENTING their line of adjustable cutting tools, the Robert H. Clark Company, Los Angeles, California, announces the new Clark Fly-Cutter for cutting holes or discs in metals of thicknesses up to one inch, including boiler plate, stainless steel, cast iron, plastics, and other materials. Among the operations which are said to have been successfully handled by the new fly-cutter is that of cutting washers and gaskets from "live" rubber.

The tool is obtainable with straight or tapered shank and covers expansions of 4 inches to 10 inches in diameter, including all decimal or fractional intermediate sizes.



Clark 2-Blade Adjustable Fly-Cutter

GM Dept. of UAW-CIO Wants Wage Increase

(*Continued from page* 74)

not employes within the meaning of the Wagner Act. The majority opinion said, "The record shows that the foremen are responsible in the first instance for production and maintenance of production schedules and that they

Specialists IN FINE MACHINING *Since* 1923

Write Us Concerning Your Requirements

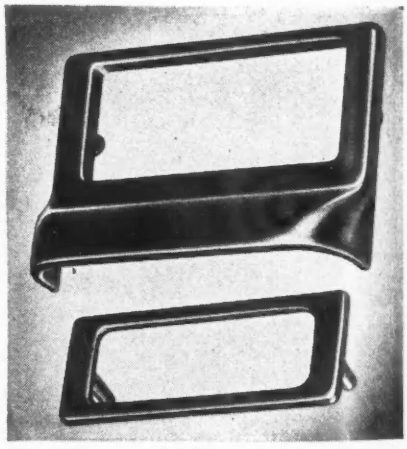
FOR 20 years leading makers of aircraft and automotive engine parts have been entrusting to us their most delicate machine work.

With a plant equipped with the most modern machinery, manned by veteran craftsmen, Govro-Nelson produces a grade of machining that is second to none.

THE GOVRO-NELSON COMPANY

1931 Antoinette Detroit, Mich.

SMC



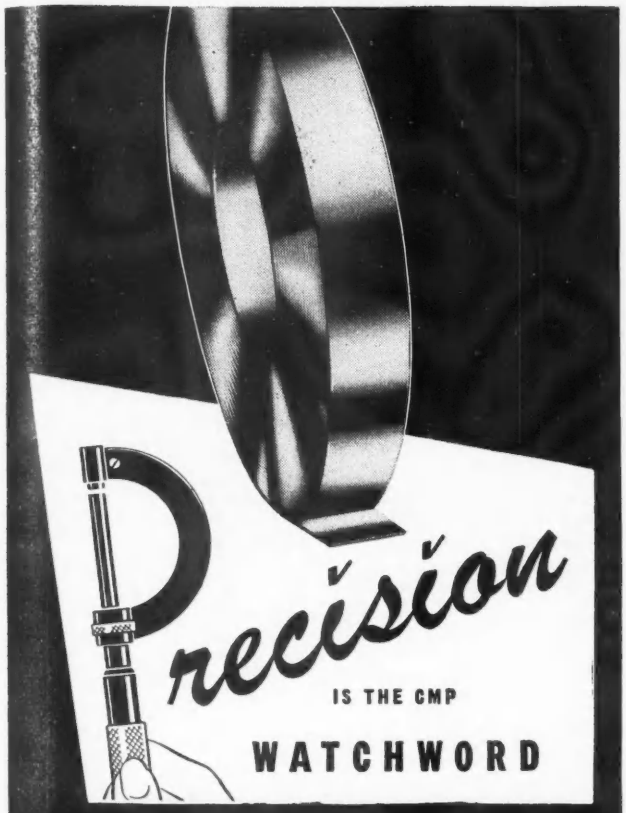
Increase Production with PLASTIC!

Plastic parts like this cabinet handle and card name holder are satisfactorily replacing metal in countless products. Ideally suited for molding to exacting tolerances, plastic is proving an important factor in sustaining profitable production levels in countless industries. If war-vital metal priorities are interrupting production in your plant, consult us. We probably can help you overcome your difficulties.

STANDARD MOLDING CORPORATION, Dayton, Ohio

100% INJECTION MOLDING

PRODUCTION DESIGN SERVICE

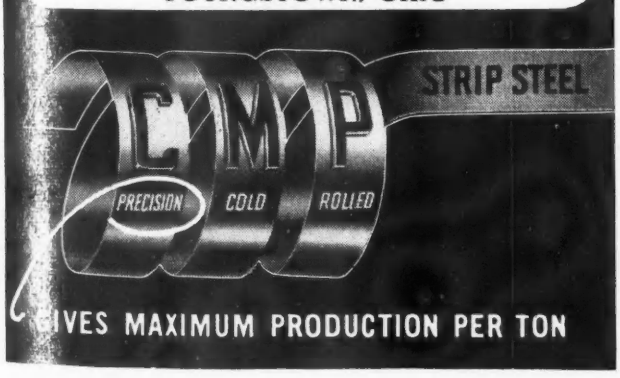


Look at CMP precision cold rolled strip steel this way—

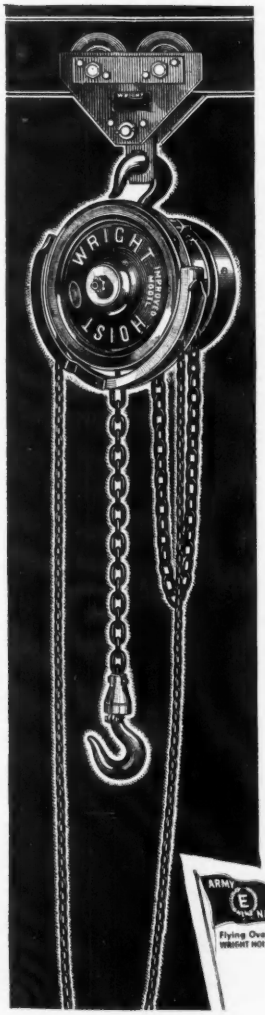
1. It is successfully replacing light gauge non-ferrous metals for vital war products.
2. It meets unusual physical characteristic requirements.
3. It consistently fulfills all rigid specifications.
4. It provides extreme accuracy to gauge.

A post-war potential for your products? Don't overlook it — perhaps you'll see many advantageous low cost applications when you investigate this versatile precision material.

The
COLD METAL PRODUCTS CO.
Subsidiary of The Cold Metal Process Co.
YOUNGSTOWN, OHIO



INSPECT REGULARLY!



Don't neglect your **WRIGHT HOISTS.** Make them last longer by regular and proper maintenance. Here are a few suggestions:

Put the grease gun to work! A **WRIGHT HOIST** needs thorough lubrication once a month. Keep the load chain well lubricated, too.

Don't overload your hoist. While **WRIGHTS** are famous for their ability to stand abuse, this is no time to abuse machinery. Overloading results in a stretched chain which cannot seat itself properly in sheave pockets, thus accelerating wear.

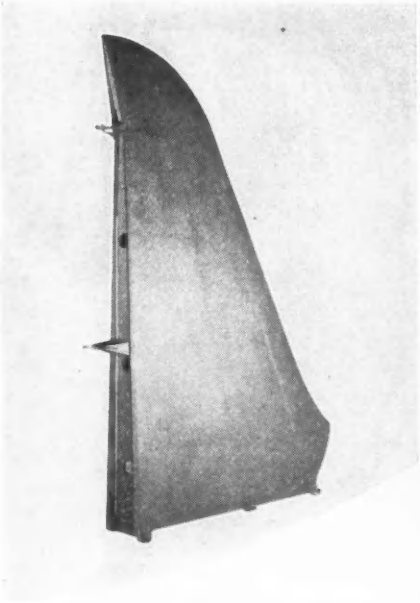
Watch the load hook. WRIGHT hooks, drop-forged from special steel, give visible warning of overloading by slowly opening. Don't continue to use hooks that have stretched.

Inspect your hoists regularly. Remember: where properly maintained, **WRIGHT HOISTS** have given continuous, trouble-free service for 20 to 25 years.

In Business for Your Safety

WRIGHT MANUFACTURING DIVISION
York, Pa., Chicago, Denver, Los Angeles, San Francisco, Portland, New York

AMERICAN CHAIN & CABLE COMPANY, INC.
BRIDGEPORT, CONNECTICUT



delivery on schedule

Getting into production quickly and maintaining or bettering required shipping schedules are the rule here at MERCURY . . . resulting from an experienced, skilled organization, specialized equipment and our own efficient tool department, giving a flexibility capable of speedily meeting changing requirements.

aircraft surfaces

A large section of our plants is devoted exclusively to the producing of aircraft surfaces, both all-metal and fabric-covered—fins, rudders, ailerons and other similar assemblies —without conflict with other departments devoted to the manufacture of aluminum fuel and oil tanks, airplane parts and accessories.

At the Cradle of Aviation

MERCURY AIRCRAFT INC.
HAMMONDSPORT · NEW YORK

GOOD SPRING DESIGN
was never MORE IMPORTANT!

With facilities crowded to the rafters, it's more important than ever to be sure every item in war production be designed and produced accurately, speedily and economically. That goes for springs, wire forms, and small stampings, too! Helping to combine operations—to eliminate waste motion—to streamline production has been common practice with B-G-R spring engineers for years. Successful experience in meeting peace-time mass-production schedules puts B-G-R in a position to meet the super-production needs of the largest spring users in the world today—our fighting forces. Let B-G-R "spring-skill" help you, too!

represent the company in the initial stage of handling grievances under the contract of the UAW-CIO. . . . There is no doubt that foremen have authority to discipline employes. From the foregoing it is clear the foremen and general foremen do not constitute an appropriate bargaining unit."

The Detroit Diesel decision followed the same pattern as that in the Maryland Drydock case. Dr. Harry A. Millis, NLRB chairman, again dissented, opining that the foremen "seek recognition by a labor organization which is both independent and unaffiliated." He favored excluding the general foremen but including the other foremen.

CLASSIFIED ADVERTISEMENT

WANTED
A PRODUCT
TO MANUFACTURE

We engineer and manufacture tools, gages, fixtures, and do close precision machine work. We prefer a product that has both a present and post-war market.

Well financed, experienced, with a sales organization calling on automotive manufacturers and jobbers nationally.

MIAMI INDUSTRIES, INC.
201 Morris Street
Toledo, Ohio

With wildcat strikes continuing to break out in automotive plants in the Detroit area, Witte, as regional WLB chairman, pointed out that all of them are illegal from a government standpoint. The War Labor Disputes Act provides for legal strikes but they can be called only after a 30-day cooling-off period and then a secret ballot among employes to be conducted by the NLRB. Witte said there should be more resorting to established grievance procedure to settle disputes rather than referring them to the WLB or staging an unauthorized strike. Prompt initial attention to grievances also was emphasized by W. B. Davis, chairman of the National WLB, who said that if a union representing employes tends to build up grievances or is unable to hold them down due to immature union development or discipline, it is of real advantage to be able to distinguish between real and unreal grievances and to settle the real ones promptly.

Most of the recent work stoppages have been over comparatively minor incidents. A total of 7123 man-hours were lost in a four-hour stoppage in the Pratt & Whitney aircraft engine building at the Ford Rouge plant. The walkout followed the dismissal of four plant committeemen who the company charged with attacking a foreman for cutting the pay of 17 women workers who left their jobs before quitting time.

EE8-A

THE EE8-A field telephone is one good reason why American-built communications equipment has a reputation for being the best there is. It is an *unclassified* (not secret) instrument, but we, whose prime war job is to build it, doubt that the enemy can match the EE8-A phone.

You see there *is* a secret to it—the secret of American know-how. For instance:

- **How to turn out such delicate, and at the same time, rugged instruments by the tens of thousands, and still have each the equal or superior of a handmade product.**
- **How to devise instruments to give *each* unit a complete "laboratory" test, in a few seconds, right on the production line.**
- **How to make telephones that will operate equally well whether they serve in arctic cold or tropic moisture.**

America has the answers. Major credit belongs to Signal Corps engineers, but *Connecticut* is proud to have had a part in making the EE8-A a weapon for helping our boys get the jump on the enemy wherever they find him.

In your postwar planning of products and factory method, you will need American know-how in the design, engineering and manufacture of precision electrical devices. We believe *Connecticut* can help you.

CONNECTICUT TELEPHONE & ELECTRIC DIVISION

GREAT AMERICAN INDUSTRIES INC.

MERIDEN, CONN.

ARMY E NAVY

For the second time within a year, the honor of the Army-Navy Production Award has been conferred upon the men and women of this Division.

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CAN you imagine what a beating tank crews would take if there were no protective crash pads to "upholster" that steel interior! BUR-TEX is ideal for the job — because, in addition to its many other features, BUR-TEX has exceptional cushioning qualities.

BUR-TEX felt fabrics are used extensively for vibration dampening, sound deadening, insulating and cushioning purposes in planes, ships, trucks, tanks, jeeps and other wartime applications. Outstanding features of the BUR-TEX "200" Line are high resistance to surface abrasion, moisture, and temperature changes — great tensile strength — pliability — and long life. What's more, all BUR-TEX fabrics are economical, easily applied — and are available in standard rolls or cut to desired forms.

Learn how BUR-TEX can solve your wartime material problems — and fit into your planning for peacetime production in the years to come.

Write for colorful, illustrated brochure, "The Interesting Story of BUR-TEX".

BURLINGTON MILLS
INCORPORATED
BURLINGTON · WISCONSIN

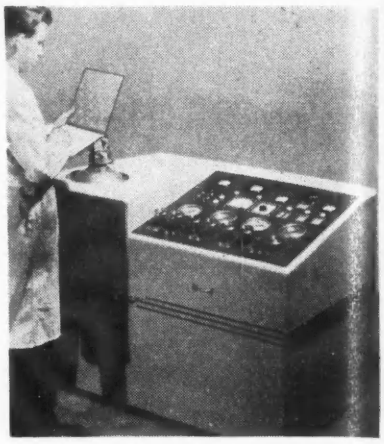
New Products

(*Continued from page* 78)

welding of thin gage strips, sheets, and tubes of stainless steel and other high chromium alloys. It is said to improve adhesive qualities, and it may be applied several hours before the actual welding operation. Solar Flux No. 16GH can be used also to protect stainless steel and other high chromium welding rod from oxidation and to promote metal flow.

New Dehydrator Prevents Corrosion

The Permutit Company, New York, N. Y., has developed a chemical, granular silica jel, that not only can absorb half its weight in moisture out of damp air, but also signals workmen when the humidity inside a war package rises above the point where rust occurs. This chemical makes possible a simple, quick technique for packaging guns, engines, planes and machinery to prevent damage by rust or corrosion. In corrosion proofing units or parts, bags of silica jel are tied in place at strategic spots and a humidity indicator card is attached where it may be seen through a transparent plastic window. A moisture proof bag is drawn over the material before crating.



Propeller Governor Test Stand

New Products for Aircraft

(*Continued from page* 58)

shaped and large in diameter to keep the cutter square with the hole. A ratchet stop, which permits depth adjustment by hand, snaps into position at each two thousandths of an inch. The positive lock-ring maintains the same depth regardless of jarring or rough use. The drive shaft runs in bronze sleeves and is equipped with a ball thrust bearing. The Model C countersink is available in two cutter sizes, 7/16 in. and ⅞ in.

Test Stand Checks Propeller Governors

A propeller governor test stand that checks Hamilton Standard double-acting, accumulator, hydromatic and constant speed governors, and Curtiss proportional and lubricated pad type governors, has just been announced by the Airplane Manufacturing and Supply Corp., North Hollywood, Cal.

The governor to be tested is mounted vertically by means of quick adjusting clamps. Two steel dowels hold the governor in alignment. The horizontal mounting pad is held to the power unit by a support and stands several inches above the top of the bench. The circular mounting pad is surrounded by a sump which drains all leakage back through a filter to the supply reservoir.

The main oil reservoir holds 14 gallons of oil. A heating element in the tank is thermostatically controlled to hold the oil temperature at 160 deg. F. Two lamps on the panel indicate the proper temperature for testing.

War Plane Specifications Require Torquing

Modern manufacturing methods call for controlled "settings" of vital nuts, screws, bolts, hydraulic fittings—of almost all threaded parts. Leading American aircraft and engine builders almost universally use the permanently accurate STURTEVANT TORQUE WRENCHES for innumerable applications ranging from building precision instruments to testing frictional drag in controls and motors. 50 models, capacities ranging from 0 to 5 inch, pounds on up to 7200 inch pounds.

Write for catalog sheets.

TRIMOUNT INCLINOMETERS

THESE instruments, widely used in the aviation industry, are designed for extremely accurate readings of low positive and negative pressures.

Multiple scale units to meet any requirements. Barometric pressure compensators, scale selectors, micro-zero leveling screws. Precision construction.

Trimount INSTRUMENT CO.

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Describes complete line of Trimount Manometers, Indicating Flow Meters, Tank Liquid Level Gauges. Get your copy now.

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